

**THE INFLUENCE OF EXECUTIVE FUNCTIONING ON READING
COMPREHENSION AMONG GRADE SEVEN PUPILS IN SELECTED PRIMARY
SCHOOLS IN ITEZHI-TEZHI DISTRICT, ZAMBIA**

BY

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This dissertation is submitted to the University of Zambia in partial fulfilment of the requirements for the Degree of Master of Education in Educational Psychology


The University of Zambia

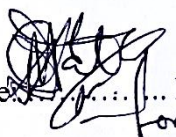
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DECLARATION

I, **Namushi Namakando**, hereby declare that, this dissertation represents my own original work and has not been previously submitted for award of any degree at the University of Zambia or any other University.

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CERTIFICATE OF APPROVAL

This dissertation by **Namushi Namakando** has been approved as fulfilling the requirements for the award of the Degree of Master of Education in Educational Psychology of the University of Zambia.

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DEDICATION

I dedicate this dissertation to my late father Mr **Isaac Simaulu Namushi** and my mother **Mbandala Simonga**. I am indebted to them for their moral and financial support throughout my academic journey.

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TABLE OF CONTENTS

DECLARATION.....	i
COPYRIGHT	ii
CERTIFICATE OF APPROVAL	iii
DEDICATION	iv
ACKNOWLEDGEMENTS	v
TABLE OF CONTENTS	vii
ACRONMS.....	xi
LIST OF FIGURES	xiii
LIST OF TABLES	xiv
ABSTRACT.....	xv
CHAPTER ONE: INTRODUCTION	1
1.1 Overview	1
1.2 Background to the study	1
1.3 Statement of the problem	4
1.4 Purpose of the study.....	5
1.5 Specific Objectives	5
1.6 Research Questions.....	5
1.7 Significance of the study.....	5
1.8 Theoretical Framework.....	5
1.9. Conceptual Framework	6
1.10. Limitation of the study.....	7
1.11. Delimitation of the study.....	7
1.12. Operational definition of terms.....	7
1.13. Summary of the chapter	8
CHAPTER TWO: REVIEW OF RELATED LETERATURE.....	9
2.1 Overview	9

2.2 Development of Executive Function	9
2.3 Global related literature on Executive functioning and reading comprehension	10
2.4 African related Literature on Executive functioning and reading comprehension.....	23
2.5 Zambian related literature on Executive functioning and reading comprehension	29
2.6 Summary of the chapter	35
CHAPTER THREE: METHODOLOGY	37
3.1 Overview	37
3.2. Philosophical Paradigm.....	37
3.3. Research Design	37
3.4. Target Population.....	38
3.5. Sample Size	38
3.6. Sampling Techniques.....	38
3.6.1 Stratified sampling technique	38
3.6.2 Simple random sampling technique.....	39
3.7. Research Instruments	39
3.7.1. Pencil Taping Test (Opposite Taping)	39
3.7.2. Behavioural Rating Inventory for Executive Functions (BRIEF2)	40
3.7.3. Delis-Kaplan Executive Function System-Trail Making Test (D. KEFS).....	40
3.7.4. Digit Span Test (Forward, Backward and Sequencing).....	40
3.7.5. Reading comprehension Assessment Tool (RCAT)	41
3.7.6. Pattern Reasoning Test (PRT)	41
3.7.7. Biographic Data Form (BDF)	41
3.7.8. Home Literacy Environment Questionnaire (HLEQ)	41
3.7.9. School Literacy Environment Checklist (SLEC).....	42
3.8. Validity and Reliability	42
3.9. Data Collection Procedure	42
3.10. Data Analysis.....	43

3.11. Ethical Considerations	43
3.12. Summary of the Chapter	43
CHAPTER FOUR: PRESENTATION OF FINDINGS	45
4.1 Overview	45
4.3 Executive function skills of seventh graders in six selected primary schools in Itezhi-tezhi District?	48
Table 4.3.5 Objective measure of executive function	48
Table 4.3.6 Subjective measure of executive function	49
4.4. Reading comprehension levels among seventh graders in six selected primary schools in Itezhi-tezhi District?	50
4.5. Correlation between executive function and reading comprehension among seventh graders in six primary schools in Itezhi-tezhi District?	50
4.6. Summary of the Chapter	52
CHAPTER FIVE: DISCUSSION OF RESEARCH FINDINGS	54
5.1 Overview	54
5.2. Effects of background variables on reading comprehension	54
5.3. Assessing executive function skills among seventh graders in six selected primary schools in Itezhi-tezhi District.....	55
5.4. Measuring reading comprehension levels among seventh graders in six selected primary schools in Itezhi-tezhi District.....	56
5.5 Correlation between executive function and reading comprehension among seventh graders in six selected primary schools in Itezhi-tezhi District.....	58
5.6. Novel Knowledge	59
5.7. Summary of the Chapter	60
CHAPTER SIX: CONCLUSION AND RECOMMENDATIONS	62
6.1 Overview	62
6.2. Conclusion.....	62
6.3. Recommendations.....	64

6.4. Implications for future research.....	64
REFERENCES.....	65
APPENDICES.....	76
Appendix 1: Approval of Study	76
Appendix 2: Pencil Tapping Test.....	79
Appendix 3: Behaviour Rating Inventory of Executive Function (BRIEF 2)	80
Appendix 4: Delis. Kaplan Executive Function System-Trail Making Test (D. KEFS- TMT; Condition 1-5)	85
Appendix 5: Digit Span	95
Appendix 6: Reading Comprehension Assessment Tool (RCAT).....	98
Appendix 7: Kaufman Pattern Reasoning Test (K-PRT)	102
Appendix 8: Biographical Data Form for Parents/Guardians	122
Appendix 9: Home Literacy Environment Questionnaire (HLEQ)	124
Appendix 10: School Literacy Environment Checklist (SLEC).....	129
Appendix 11: Participant Information Sheet	131
Appendix 12: Informed Consent Form.....	136

ACRONMS

PL:	Phonological loop
VSSP:	Visual spatial sketchpad
EB:	Episodic Buffer
PTT:	Pencil Taping Test
BRIEF2:	Behavioural Rating Inventory for Executive Functions second edition
D.KEFS (TMT):	Delis-Kaplan Executive function system: Trial Making Test
DS:	Digit Span
EF:	Executive function
RCAT:	Reading Comprehension Assessment Tool
UNZA:	University of Zambia
QERD:	Quasi-Experimental Research Design
BDF:	Biographic Data Form
KPRT:	Kaufman's Pattern Reasoning Test
RESUZ:	Reading Support for Zambian children
TS:	T-Score
SS:	Scaled Score
FL:	Frontal lobe
STM:	Short Term Memory
LTM:	Long Term Memory
SES:	Socio-economic status
HLEQ:	Home Literacy Environment Questionnaire
SLEQ:	School Literacy Environment Questionnaire

DQC:	Data Quality Control
BDF:	Biographic Data Form
RD:	Reading Disability
GRD:	General Reading Disability
S-RCD:	Specific reading comprehension deficits
UNZA-HSSREC:	University of Zambia Humanities and Social Sciences Research Ethical Committee
DEBS:	District Education Board Secretary
WASI:	Wechsler Abbreviated Scale of Intelligence
SPSS:	Statistical Package for Social Sciences
ADHD:	Attention Deficit Hyperactivity Disorder
ESL:	English as Second Language
SACMEQ:	Southern and Eastern African Consortium for monitoring Education Quality
PPIRLS:	Pre-Progress in International Reading Literacy Study
ECG:	Electrocardiography
BASAT:	Basic Assessment Skill Assessment Tool
ECCE:	Early Childhood Care and Education

LIST OF FIGURES

Figure 1: Conceptual Framework	7
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LIST OF TABLES

Table 4.2. Demographic characteristics of participants.....	45
Table 4.3. Associations between demographic characteristics and Home Literacy....	46
Table 4.4.1 Objective measure of executive function	48
Table 4.4.2 Subjective measure of executive function	49
Table 4.5.1 Performance scale on Reading comprehension Assessment Tool (RCAT)	50
Table 4.6.1 Correlation between Reading comprehension and objective measures of executive function skills	51
Table 4.6.2 Correlation between Reading comprehension and subjective measures of executive function skills	51

ABSTRACT

The purpose of this study was to assess the influence of executive functioning on reading comprehension among grade seven pupils in selected primary schools in Itezhi-tezhi District. The objectives of the study were to: assess executive function skills among seventh graders, measure reading comprehension levels among seventh graders and establish correlation between executive function and reading comprehension among seventh graders. The study utilized a quasi-experimental design. A total sample size of 216 respondents comprising pupils and parents was used in the study. The study used simple and stratified random sampling techniques to select respondents. Data was collected using the following testing tools: Behavioural Rating Inventory for Executive Functions second edition (BRIEF2) as a subjective measure of executive function, Delis-Kaplan Executive function system (D-KEFS), Digit Span, Pencil Taping (opposite taping) as objective measure of executive function, Reading Comprehension Assessment Tool (RCAT), Kaufman's Pattern Reasoning Test (K-PRT), Biographic Data Form (BDF), Home Literacy Environment Questionnaire (HLEQ) and School Literacy Environment Checklist (SELCE). Data was analysed using Stata version 14 and both descriptive and correlations were performed.

The study found that a greater number $n=75$ (69%) of seventh graders had poor executive function skills when tested using objective measures of executive function. Only a minority $n=25$ (31 %) had good executive functions. On the subjective measure of executive function skills using Behavioural Rating Inventory for Executive Functions (BRIEF2), the study found that a greater number $n=78$ (72%) of seventh graders exhibited good executive function skills and only a minority $n=30$ (28%) had poor executive functions. On reading comprehension, the study found that a greater number $n=47$ (44%) of the seventh grader's performance was average. However, this was not the expected result as only 16 (15%) performed above average and 45 (42%) performed below average.

To establish the relationship between executive function and reading comprehension among seventh graders, correlation was performed on both objective and subjective measures of executive function skills. The results on objective measures of executive function skills indicate that there is a statistically significant relationship between reading comprehension and the core executive function skills ($p<0.001$). On subjective measures of executive function, the study found a statistically significant relationship between reading comprehension and the core executive function skills. For instance, Inhibitory control ($r = -0.21$, $p=0.03$), Cognitive flexibility ($r = -0.22$, $p=0.02$), Working memory ($r = -0.22$, $p=0.02$). However, two other sub domains under subjective measures of executive function had a statistically significant relationship with reading comprehension as well (Task monitor ($r = -0.19$, $p=0.05$) and Organisation of materials ($r = -0.25$, $p=0.01$). A difference was noted with Self-monitor ($r = -0.06$, $p=0.54$), Emotional control ($r = -0.03$, $p=0.72$), Initiate ($r = -0.18$, $p=0.07$), Plan and organise ($r = -0.18$, $p=0.06$) which indicated no statistically significant relationship with reading comprehension. Based on the aforementioned findings, the study recommends that Curriculum Development Centre (CDC) should make school curriculum responsive enough to accommodate and promote early stimulation of executive function skills among primary school children. Schools should adopt and prepare lessons tailored to measure the constructs of executive function skills. There is need for schools to create reading material banks within classrooms for easy accessibility in order to promote and enhance reading culture among primary school children.

Keywords: *Executive Function, Working Memory, Inhibitory Control, Cognitive Flexibility and Reading Comprehension.*

CHAPTER ONE: INTRODUCTION

1.1 Overview

This chapter focuses on the background to the study, statement of the problem, purpose of the study, research objectives research questions, significance of the study, theoretical framework, Conceptual Framework, Limitations, delimitation, and operational definition of terms.

1.2 Background to the study

Executive function is one among the subdomains of cognitive functions which include language, working memory, episodic memory, processing speed and attention (Barkley, 2012). Multiple studies have shown the importance of executive function among people in both developed and developing countries (Cecile, Arief and Ludovica, 2017, Zelazo, Blair and Willoughby, 2017, Mwanza-Kabaghe, 2015, Mwanza-Kabaghe, Mubanga, Matafwali, Kasonde-Ng'andu and Bus, 2015, Bull and Lee, 2014, Barkley, 2012, Flook and Smalley, 2010, St Clair-Thompson and Gathercole, 2006). Executive function is an umbrella term that refers to a set of mental tools that are used to manage tasks and achieve goals (Anderson, 2002). Executive functions consist of several brain-based skills that help people to organize, act on information, initiate, and perform tasks (Barkley, 2012). These skills enable people to plan, organize, remember things, prioritize, pay attention and get tasks started. Executive function also helps people to use information and experiences from the past to solve current problems.

There is understanding and agreement amongst scholars that the core or most basic executive function skills include working memory, inhibitory control and cognitive flexibility (shift) (Diamond, 2013, Best and Miller, 2010, Friedman, Miyake, Corley, Young, DeFries, and Hewitt, 2006, Witzki and Howerter, 2000, Miyake, Friedman, Emerson, Witzki, Howerter and Wager, 2000). These three core components of Executive function are dissociable implying that in practice, it is impossible to test one component to the complete exclusion of others. Inhibitory control involves being able to control one's attention, behaviour, thoughts or emotions to override strong internal predispositions or external lures, and instead do what is more appropriate or needed at a given time. (Miyake et al., 2000). Without inhibitory control, one would be at the mercy of impulses, old habits of thought, action or stimuli in the environment. This means that inhibitory control makes it possible for one to change, choose how to react and behave in a particular way rather than being unthinking creatures of habit. The ability to exercise inhibitory control creates the possibility of change and choice. (Müller

and Kerns, 2015). Inhibitory control enables people to selectively attend, focusing on what one chooses and suppressing attention to other stimuli. Inhibitory control is a prerequisite of reading ability, both at the start of reading acquisition, and at the mastering of competence. Involvement of inhibitory control at the level of decoding letters make it possible to capture differences and similarities in the shapes of letters, size and location of the graphic characters and phonemic relations. In turn, at the level of comprehension, it facilitates not only understanding the literal meaning of text, but also assimilation and accommodation of the new knowledge to already existing structures. (Kamza, 2017). Similarly, Walczyk in his Compensatory-Encoding Model of Reading (Walczyk, 2000) emphasizes the role of attention control, especially in the aspect of inhibition in reading skill acquisition. He further maintains that reading involves a monitoring process, which can be interrupted when there is a problem. This happens when the reader pauses, looks back, or re-reading a word which is misunderstood. For example, if a meaning of the word was incorrectly inferred and it does not fit into the broader context, it can be suppressed and replaced by another which is more appropriate. In turn, if the word was mistakenly decoded, further processing must be halted for re-decoding with a greater involvement of attention resources. Moreover, (Müller and Kerns, 2015) postulates that inhibitory control mechanism is an important factor in reading. In their empirical study, they found that inhibitory control contributes significantly to the growth of reading skills, and that it serves as a better predictor of reading comprehension than articulation speed, phonemic awareness and intelligent quotient. It is important to note that, besides working memory and cognitive flexibility, inhibitory control is an important component of the set of higher order cognitive processes involved in the conscious control of thought and action and has a significant contribution to reading comprehension. (Carlson and Moses, 2001; Zelazo and Müller, 2002).

Working memory is the second core skill in executive function which refers to a system for holding and manipulating information as part of a wide range of essential cognitive tasks such as learning, reasoning and comprehending written or non-written materials. (Baddeley, 1997) Working memory is necessary for making sense of written work or spoken language be it a sentence, a paragraph, passage or doing mathematics mentally. Working memory is responsible for mental re-ordering of items, translating instructions into action, incorporating new information into thinking, considering alternatives, and mentally relating information to derive a general principle (Müller and Kerns, 2015) Working memory as an aspect of executive function has been associated with reading ability. Children with dyslexia show deficits on

working memory tasks in both verbal and visual domains (Reiter, Tucha and Lange, 2005) A cross-sectional study examining verbal working memory in children with reading disabilities relative to skilled readers aged between 7 to 20 noted that while working memory skills improved with age among the skilled readers, little age-related change was observed in children with reading disabilities, such that the difference between groups increased steadily over time. (Swanson, 2003). Working memory also has been linked specifically to reading comprehension, both in normal, highly experienced readers and in impaired readers (Carpenter and Just, 1988, Just and Carpenter, 1992, Swanson, 1999, Swanson and Alexander, 1997, Swanson, Ashbaker and Sasche-Lee, 1996, Swanson and Berninger, 1995, Swanson and Jerman, 2007, Swanson and Trahan, 1996)

Greater working memory capacity is thought to facilitate reading comprehension through the availability of ample cognitive resources to simultaneously engage in multiple reading processes such as decoding unfamiliar words, retrieving semantic knowledge of familiar words, recalling previously read text, and anticipating where the passage is going. (Swanson, 2003) Some studies conducted to explore whether executive functions, particularly working memory and planning skills, represent an additional component of reading after accounting for individual differences in attention, basic decoding skills, reading fluency, and vocabulary. Specifically, these studies have hypothesized that working memory is significantly associated with reading comprehension skills, thereby suggesting that it is a potential contributor to reading comprehension ability. (Reiter, Tucha and Lange, 2005, Walczyk, 2000).

Cognitive flexibility is the third core executive function skill sometimes called set shifting which is the extent to which one can volitionally shift his or her attention between different tasks, operations, or cognitive sets (Miyake et al., 2000; Monsell, 1996). Cognitive flexibility refers to the ability to shift attention from one activity to another or to actively switch back and forth between important components of a task. Cognitive flexibility is represented by the degree to which one can flexibly and efficiently shift from the demands of an old cognitive set or rule to those of a new one and plays a significant role in influencing reading comprehension. In a reading comprehension task, cognitive flexibility helps a reader to actively shift focus between many things, such as word and text meanings, letter-sound information, and syntactic (sentence grammar). This has demonstrated that Cognitive flexibility has a direct and unique association with reading comprehension attainment. (Kieffer, Vukovic and Berry, 2013).

Executive function has been widely recognised and researched in terms of underpinning successful goal-directed tasks, and is linked to educational attainment in literacy, mathematics and academic achievement. (Cecile, Arief and Ludovica, 2017, Zelazo, Blair and Willoughby, 2017, Mwanza-Kabaghe, 2015, Keli, 2014, Bull and Scerif, 2001; McClelland et al. 2007, St. Clair-Thompson and Gathercole, 2006, Alexander, Entwisle and Dauber, 1993). Ability to read has been linked to several aspects of executive functioning using tests of working memory, inhibition and cognitive flexibility. It has also become increasingly evident that difficulties in reading to a larger extent is associated with an elevated risk of poor executive functioning among school going children (Zelazo, Blair and Willoughby, 2017, Barkley, 2012). Southern and Eastern African Consortium for monitoring Education Quality (SACMEQ) report, (2016) and some Zambian studies done in the area of reading (Mulenga, 2017, Tambulukani, 2015, Chansa-Kabali, 2014, Mutale, 2013, Matafwali, 2010; Mwambazi, 2011, Nkosha, 2011; Chazangwe, 2011) have shown low reading levels among Zambian learners especially at primary school level. However, these studies never endeavoured to investigate the influence of executive functioning on reading comprehension. On the other hand, few Zambian studies conducted in the area of executive function, literacy and numeracy mainly at lower primary school levels have equally never focused on the influence of executive functioning on reading comprehension at grade seven school level (kalumba, 2017, Mwanza-Kabaghe, 2015, Mwanza-Kabaghe, et al. 2015).

1.3 Statement of the problem

Reading comprehension skills help learners to improve their academic performance (Maixner, Warne, Lensing, Schiefele and Elsner, 2018; Iglesias-Sarmiento, López, Juan and Rodríguez, 2015; Best, 2010; Swanson, 1999). Studies done in Zambia have shown low reading levels among school-going children (Mulenga, 2017; SACMEQ report, 2016; Tambulukani, 2015; Chansa-Kabali, 2014; Mutale 2013). If this trend of low reading levels is left unchecked, children would continue exhibiting poor reading skills thereby defeating Government's efforts of promoting a literate populace which can be disastrous for a country. However, there was inadequate information on the influence of executive function on reading comprehension at grade seven school level particularly in Itezhi-tezhi District, a knowledge gap that the current study addressed.

1.4 Purpose of the study

The purpose of this study was to assess the influence of executive functioning on reading comprehension among learners at grade seven School level in six selected public primary schools in Itezhi-tezhi District.

1.5 Specific Objectives

1. To assess executive function skills among seventh graders in six selected primary schools in Itezhi-tezhi District.
2. To measure reading comprehension levels among seventh graders in six selected primary schools in Itezhi-tezhi District.
3. To establish correlation between executive function and reading comprehension among seventh graders in six selected primary schools in Itezhi-tezhi District.

1.6 Research Questions

1. How are the executive function skills of seventh graders in six selected primary schools in Itezhi-tezhi District?
2. What are the reading comprehension levels among seventh graders in six selected primary schools in Itezhi-tezhi District?
3. What is the correlation between executive function and reading comprehension among seventh graders in six selected primary schools in Itezhi-tezhi District?

1.7 Significance of the study

The findings of this study may provide an insight on the influence of executive functioning on reading comprehension among seventh graders in schools and may give room for further research. Policy makers and stakeholders may use findings of this study to make decisions which may mitigate the low reading levels recorded among school going children. The findings of the study may add value to the existing body of knowledge. Further, this study was important as knowledge of EF levels would help understand why some learners perform poorly at grade seven level since EF skills are vital for goal setting which is important to pass an exam. Therefore, if left unchecked efforts may be directed elsewhere when simple EF stimulating activities could be a solution to the problem.

1.8 Theoretical Framework

This study was guided by a multi-component model (theory) expounded by Baddeley (1996). This theory holds that different executive function domains contribute differently and

simultaneously during cognitive processing. A capacity limitation or processing inefficiency in one or more of these executive function domains contribute to variability in reading performance (Baddeley, 1996, 1999, 2000 and 2003). The theory also indicates that phonological loop (PL) and visual spatial sketchpad (VSSP) are distinct brain regions involved during reading comprehension. Phonological loop (PL) is responsible for processing verbally based information, and visual spatial sketchpad (VSSP) is responsible for processing visual and visual-spatial information. (Swanson, 1999). The theory further states that episodic buffer (EB) is responsible for processing information from the phonological loop (PL) and visual spatial sketchpad (VSSP). The Episodic Buffer's functions is to integrate verbal, visual-spatial and long-term information in a brain-system that is fundamentally heterogeneous. The episodic buffer (EB) is necessary for holding information that exceeds the capacities of the Short Term Memory (STM) during complex cognitive reasoning tasks such as reading comprehension and integrating information into long term memory (LTM). (Baddeley, 2003).

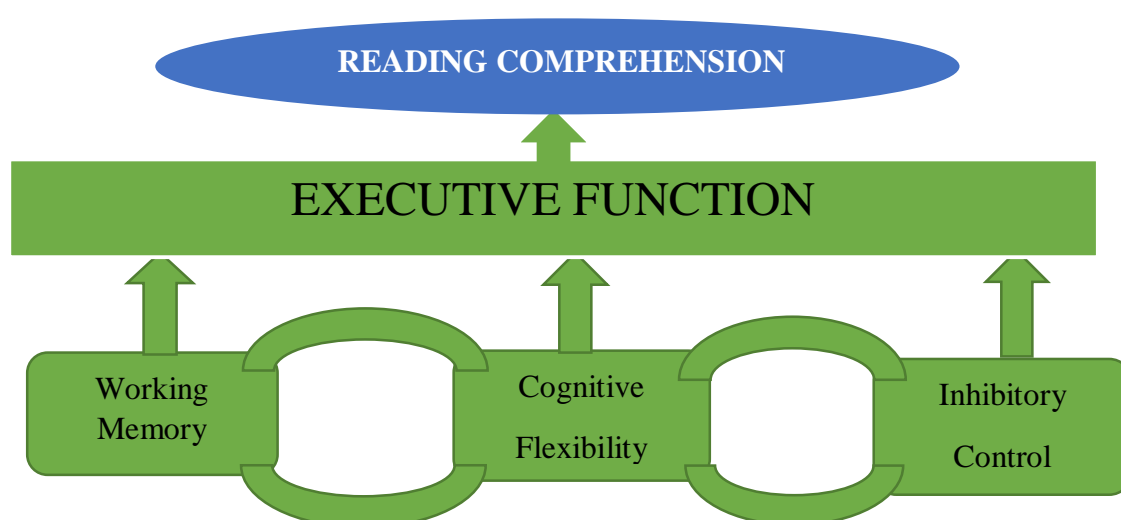
This study assessed the influence of executive functioning on reading comprehension among grade seven learners in schools. Therefore, the relevance in applicability of this theory to the current study helped to explain that reading comprehension involves complex cognitive processing which rely on engaging executive functioning to maintain word meanings. (Swanson, 1999). This entails that executive function as an attentionally based control system, inhibits and selects relevant information during reading comprehension, an area which was central for the current study. Better still, this study was grounded well on this theory because numerous studies for example (Kalumba, 2017, Best, 2010 and Mwanza-Kabaghe, 2015) have shown theoretical links between Baddeley's multi -component model (theory) and reading.

1.9. Conceptual Framework

A conceptual framework is an image or symbolic representation of an idea which operationalizes a theory used in a study. Conceptual framework helps a researcher to understand how independent and dependent variables interact and how they may influence the outcome of a particular study. (Chinn and Kramer, 1999; Sahaya and Selvam, 2017). Conceptual framework forms a basis on which a researcher understands researchable variables in a given study and this may give guidance on which literature to interrogate. The conceptual framework used in this study shows a diagrammatic representation that explains how working memory, cognitive flexibility and inhibitory control being the three core executive function skills with equal weight in contribution to influence reading comprehension. The assumption

was that if the core executive function skills (working memory, cognitive flexibility and inhibitory control) were poor in these children then even their reading comprehension was poor as well. For instance, what affects executive function skills would as well affect reading comprehension as illustrated in figure 1 below;

Figure 1: Conceptual Framework



Source: Adapted from Swanson (1999)

1.10. Limitation of the study

Every study may have limitations which are potential weaknesses. The standardised instruments used in this study required high level of concentration on the part of the researcher during administration. This implies that any slight lack of concentration on the part of researcher may have slightly distorted the findings

1.11. Delimitation of the study

The scope of this study was restricted only to only six selected public primary schools in Itezhi-tezhi District which encompassed parents and learners as the main respondents.

1.12. Operational definition of terms

Executive function:	A group of cognitive abilities (i.e. working memory, inhibitory skills, and attention) that control and regulate behaviours that are required for learning.
Inhibitory Control:	Ability to control one's attention, behaviour, thoughts or emotions to override a strong internal or external lure.

Cognitive flexibility:	Ability to shift attention from one activity to another.
Working Memory:	Ability to hold new information in mind long enough to manipulate it for the purpose of solving a problem or accomplishing a task.
Frontal lobe:	Front section of the brain housing executive function.
Cognition:	mental action or process of acquiring knowledge and understanding through thoughts, experience and senses.
Attainment:	Acceptable completion level.
Brain:	Control centre for actions, behaviour and emotions
Reading comprehension:	Ability to read a passage with understanding and manage to extract and construct meaning from it.
Reading:	The ability to learn, interpret words, letters and other symbols.
Literacy Exposure:	Ability to interact with or have access to literacy materials or family members who can read and write in a home.
Non-Literacy Exposure:	Inability to interact with or have access to literacy materials or family members who can read and write in a home

1.13. Summary of the chapter

The chapter has given background to the study on the influence of executive function on reading comprehension. The other specifications presented in the chapter include, statement of the problem, purpose of the study, research objective and research questions, significance of study, theoretical framework, limitations of the study, delimitation of the study, and operational definition of terms. The next chapter presents review of related literature.

CHAPTER TWO: REVIEW OF RELATED LETERATURE

2.1 Overview

The previous chapter gave an insight on the background of the study, statement of the problem, purpose of the study, research objectives and research questions, significance of the study, theoretical framework, delimitation, limitation and operational definition of terms. This chapter starts by giving development perspective of Executive function and then reviews some related literature on the influence of executive functioning on reading comprehension. The literature will be arranged according to Global, Africa and finally Zambian perspectives.

2.2 Development of Executive Function

Executive function is a collection of cognitive processes that are responsible for problem-solving, cuing, guiding, managing goal-directed behaviour, cognitive and emotional functions specifically during novel tasks. EF is responsible for accomplishment of day to day activities. (Cecile, Arief and Ludovica, 2017). EF develop slowly from prenatal through early childhood and adolescence, and may still improve into young adulthood (Anderson, 2002). Furthermore, in academic area, students who persistently experience academic problems especially in reading despite having average intelligence and the absence of learning disabilities or psychological processing deficits are likely to be demonstrating weaknesses that EF contribute to their academic struggles (Bull and Lee, 2014)

The development of EF occurs over a developmental continuum from infancy through early adulthood, with self-regulation executive functions typically becoming more fully developed during an individual's late 20s. (Diamond, 2013). EF continues to develop even in early adulthood, but it shows prolific substantial growth in infancy and childhood (Flook and Smalley, 2010). The frontal lobes have control over many body functions. (Diamond, 2013). This part of the brain continues to develop through adolescence. Some of the functions of the frontal lobes include managing body movement (motor function), emotions, attention, motivation, and other thinking functions such as decision-making, judgment, abstract reasoning, planning and completing tasks, working memory Without adequate development and engagement of EF, learners demonstrate difficulty performing academic tasks consistent with expectations (Best and Miller, 2010).

Injury to the frontal lobe is the most common cause of executive dysfunction (Müller and Kerns, 2015). The importance of EF is shown by the difficulties caused by executive

dysfunction since EF is involved in most routine activities, frontal lobe injuries can lead to deficits in cognitive (thinking) skills, personality and social behaviour. Problems with thinking ahead and carrying out the sequence of steps needed to complete a task. (Zelazo and Müller, 2002). This can often be mistaken for 'laziness' or a lack of motivation and energy, rigidity in thoughts and actions which leads to difficulty in evaluating the result of actions and reduced ability to change behaviour or switch between tasks if needed, difficulties with memory and attention causes lack of concentration and learning new information. (Reiter, Tucha and Lange, 2005; Swanson, 2003). Further, empirical evidence indicates that capacity limitation or processing inefficiency in one or more of EF domains due to executive dysfunction contribute to variability and poor reading performance (Baddeley, 1996; Zelazo et al, 2017; Swanson and Alexander, 1997).

2.3 Global related literature on Executive functioning and reading comprehension

Executive functions are high-level cognitive skills used to meet challenges and accomplish goals. They assist in organizing behaviour in order to inhibit impulses, plan and organize activities, sustain attention, persist to the completion of tasks, and manage and regulate emotions, behaviour in order to accomplish a goal or task. (Ahmed, Tang, Waters and Davis-Kean, 2019). Anderson, (2002) contended that executive functions assist in two ways: problem solving and guidance. In order to problem solve a task, planning, organization, time management, working memory, and metacognition skills are used. Once a plan has been outlined, executive function is utilized to guide behaviour in order to execute the plan and achieve the goal.

Studies conducted at Global level indicate that Executive functioning can greatly impact a student's ability to learn and achieve, especially in numeracy and reading. It is important to note that without adequate engagement of executive functioning, learners demonstrate difficulty performing academic tasks consistent with expectations. (Chrysochoou, Bablekou, and Tsigilis, 2011; Šimleša, Cepanec, and Ljubešić, 2017; Bailey, Andrzejewski, Greif, Svingos and Heaton, 2018; Ahmed, Tang, Waters and Davis-Kean, 2019).

A study by Ahmed, Tang, Waters and Davis-Kean (2019) on Executive function (EF) and academic achievement: Longitudinal relations from early childhood to adolescence in Washington DC that used Data from the NICHD Study of Early Child Care ($N = 1273$) assessed the longitudinal relations among executive function (EF) components in early childhood (54 months) and adolescence (15 years) and their prediction of academic achievement. The study

found that after controlling for early achievement, demographic, and home environment variables, only working memory at 54 months significantly predicted working memory at 15 years and that working memory was the only significant EF predictor of achievement at age 15. In contrast, all early achievement measures were significant predictors of later achievement. Furthermore, no demographic or home environment variables at 54 months significantly predicted EF at 15, and only maternal education significantly explained variance in adolescent Math and Literacy achievement. These findings demonstrate the predictability of working memory and highlight its importance for academic outcomes across development. However, the lack of associations of preschool inhibition and attention measures, after controlling for early achievement, demographic, and home environment variables, to corresponding measures in adolescence suggests the need for more developmentally sensitive measures of EF. Given that the EF measures used in this study are commonly used in educational and psychological research, more care should go into understanding the psychometric properties across development. While the aforementioned study was a longitudinal and focused on Executive function and academic achievement, its results demonstrated that the predictability of working memory highlighted its importance for academic outcomes across development from early childhood to adolescence in Washington DC, it was not known whether working memory as a measure of executive functioning can predict the importance of academic outcomes through reading comprehension among the seventh graders at middle primary school level in Itezhi-tezhi District in Zambia.

Chrysochoou, Bablekou, and Tsigilis (2011) conducted a study at the University of Illinois on Working Memory Contributions to Reading Comprehension Components in Middle Childhood Children. The phonological loop of the Baddeley and Hitch working memory model was assessed with 3 recall tasks (words, no words, and digits) and a word list matching task. The central executive (CE) was assessed with 3 tasks (listening, counting, and backward digit recall and Brief). Participants were also given a receptive vocabulary task, a reading fluency task, and written stories accompanied by comprehension questions. Canonical correlation analyses showed that the comprehension variables were related to the CE rather than the phonological loop measures. CE functions were more strongly associated with elaborative inference generation (involving significant offline processing) and comprehension control (involving metacognitive monitoring). Smaller yet significant associations were observed between the CE and the necessary inference and literal comprehension measures, whereas a moderate relationship was found in the case of the simile comprehension variable. Among the CE

variables, listening recall demonstrated the highest loading on the canonical function, followed by moderate yet significant counting and backward digit recall loadings. Vocabulary was found to fully mediate several associations between working memory and comprehension measures; however, the relationship between listening recall and elaborative inferences was partly mediated. Reading fluency and, on several occasions, Greek vocabulary knowledge did not mediate the relationships between CE measures and comprehension skills assessed. This study demonstrates the usefulness of CE measures for identifying young children's possible difficulties in carrying out specific reading comprehension processes. The information from the above reviewed study is insightful in that it has highlighted cardinal components of Working Memory Contributions to Reading Comprehension Components in Middle Childhood children in the United States of America. The results of the study revealed that vocabulary fully mediated several associations between working memory and comprehension measures and that the relationship between listening recall and elaborative inferences was partly mediated. This was reason enough to carry out this study on the influence of executive function on reading comprehension among the grade seven primary school pupils in Zambia particularly in Itezhi-tezhi.

A study done in Croatia by Šimleša, Cepanec, and Ljubešić (2017) on the role of executive functions in language comprehension in Preschool Children. The aim of the study was to examine the relationship among various aspects of executive functions (inhibitory control, working memory, planning and cognitive flexibility) and language comprehension in preschool children. The final sample included 203 children, four or five-year-old, with average nonverbal cognitive development. The measuring instruments for assessment of the children's executive functions were Grass/Snow task; Inhibition task (NEPSY-II); Digit Span task; CANTAB tasks, Dimensional Change Card Sort and Brief. The Reynell Developmental Language Scales were used for assessment of language comprehension. The results showed that the only significant predictors of language comprehension were verbal working memory, as measured by the Digit Span task, and inhibitory control, as measured by the Grass/Snow task. The study emphasised the importance of inhibitory control and working memory for language comprehension in preschool children. The aforementioned study differs from the current study as it concentrated on the role of executive functions in language comprehension in Preschool Children while the current study focused on the influence of executive function on reading comprehension among seventh graders at middle primary school level in Itezhi-tezhi District, Zambia.

A study by Cutting, Materek, Cole, Levine and Mahone (2009) on Effects of fluency, oral language, and executive function on reading comprehension performance in United States of America revealed that reading disability (RD) typically consists of deficits in word reading accuracy and/or reading comprehension. While it is well known that word reading accuracy deficits lead to comprehension deficits (general reading disability, GRD), less is understood about neuropsychological profiles of children who exhibit adequate word reading accuracy but nevertheless develop specific reading comprehension deficits (S-RCD). Establishing the underlying neuropsychological processes associated with different RD types is essential for ultimately understanding core neurobiological bases of reading comprehension. The study investigated isolated and contextual word fluency, oral language, and executive function on reading comprehension performance in 56 9- to 14-year-old children [21 typically developing (TD), 18 GRD, and 17 S-RCD]. Results indicated that TD and S-RCD participants read isolated words at a faster rate than participants with GRD; however, both RD groups had contextual word fluency and oral language weaknesses. Additionally, S-RCD participants showed prominent weaknesses in executive function. Implications for understanding the neuropsychological bases for reading comprehension are discussed. The study by Cutting and others (2009) investigated isolated and contextual word fluency, oral language, and executive function on reading comprehension performance in 56 9- to 14-year-old children in United States of America, the current study focused on the influence of executive function on reading comprehension among the Grade seven in Zambia particularly in Itezhi-tezhi primary schools.

A study conducted in United States of America by Bailey, Andrzejewski, Greif, Svingos and Heaton (2018) on the role of executive functioning and academic achievement in the academic self-concept of children and adolescents referred for neuropsychological assessment. The study evaluated a model of youth academic self-concept which incorporates practical executive functioning behaviours and academic achievement. Though greater academic achievement has been linked to both positive self-concept and better executive functioning, these constructs have not been examined simultaneously. It was hypothesized that academic achievement would mediate the association between problems with executive functioning and academic self-concept such that youth with more problems with executive functioning would have lower academic achievement and, in turn, lower academic self-concept. Clinical data was analysed from a diagnostically heterogeneous sample of youth ($n = 122$) who underwent neuropsychological evaluation. Problems with executive functioning were assessed using the Behaviour Rating Inventory of Executive Function. Academic achievement was assessed using

the Woodcock–Johnson Tests of Achievement or Wechsler Individual Achievement Test. Academic self-concept was assessed using the youth-report version of the Behavioural Assessment System for Children. Surprisingly, findings indicate that academic achievement is not significantly associated with problems with executive functioning or academic self-concept. However, greater problems with executive functioning are associated with decreased academic self-concept. The overall model included several covariates and accounted for 10% of the variance in academic self-concept. Findings suggest that executive skills may be essential for aligning academic achievement with classroom performance. Though various child characteristic covariates were included, the model accounted for a small amount of variance suggesting that future studies should examine contributing contextual factors. The above study differs from the current study as it focused on the role of executive functioning and academic achievement in the academic self-concept of children and adolescents referred for neuropsychological assessment and the current study targeted to establish the influence of executive function on reading comprehension among seventh graders at middle primary school level in Zambia.

Kieffer, Vukovic and Berry (2013) did a study on roles of attention shifting and inhibitory Control in Fourth-Grade Reading Comprehension. This study investigated the relations between two specific dimensions of EF-attention shifting and inhibitory control-and reading comprehension for students in fourth grade ($N = 120$). Specifically, the study used path analysis to investigate the direct, unique associations of attention shifting and inhibitory control with reading comprehension as well as the indirect associations with reading comprehension via language comprehension and word reading, controlling for working memory, processing speed, and phonological awareness. Results indicated that both attention shifting and inhibitory control demonstrated unique direct associations with reading comprehension. Attention shifting also demonstrated a significant indirect association via language comprehension. Findings support growing evidence for the importance of these EF dimensions to reading, raise questions about potential mechanisms underlying links between EF and reading comprehension, and offer implications for understanding and addressing reading comprehension difficulties. The aforementioned study is insightful to the current study as it has highlighted cardinal information on role of attention shifting and inhibitory control on reading. While the above study focused on the on roles of attention shifting and inhibitory control on reading Comprehension at grade four level, the current study assessed the influence of executive function on reading comprehension among the seven graders in Zambia.

Similarly, a study by Jerman, Reynolds and Swanson (2012) investigated whether Growth in Working Memory Span or Executive Processes Predict Growth in Reading and Math in Children with Reading disabilities in private schools in United States of America. The study investigated whether (a) growth patterns related to cognitive processing (working memory, updating, inhibition) differed in subgroups of children with reading disabilities (RD) and (b) growth in working memory (executive processing) predicted growth in other cognitive areas, such as reading and math. Seventy-three children (ages 7-17) categorized as poor decoders, poor comprehenders, or average readers were administered a battery of achievement and cognitive measures for three consecutive years. Hierarchical linear modelling showed that growth in executive processing (inhibition) in children with RD constrained growth in reading and math. The results support the notion that development in the executive system underlies performance on reading and math. Jerman, Reynolds and Swanson's study was conducted in private Schools in California and investigated whether Growth in Working Memory Span or Executive Processes Predict Growth in Reading and Math in Children with Reading Disabilities, the current study assessed the influence of executive function on reading comprehension among the seven graders in public schools in Zambia.

Maixner, Warner, Lensing, Schiefele and Elsner (2018) did a study in German on relationship between executive function and reading comprehension. The longitudinal study explored the bidirectional relations between executive functions and reading comprehension during primary school across a 1-year period. At two time points (T1, T2), we assessed reading comprehension at the word, sentence, and text levels as well as three components of executive functioning, that is, updating, inhibition, and attention shifting. The sample consisted of three sequential cohorts of German primary school students (N = 1657) starting in first, second, and third grade respectively (aged 6–11 years at T1). Using a latent cross-lagged-panel design, we found bidirectional longitudinal relations between executive functions and reading comprehension for second and third graders. However, for first graders, only the path from executive functioning at T1 to reading comprehension at T2 attained significance. Succeeding analyses revealed updating as the crucial component of the effect from executive functioning on later reading comprehension, whereas text reading comprehension was most predictive of later executive functioning. The potential processes underlying the observed bidirectional relations are discussed with respect to developmental changes in reading comprehension across the primary years. The aforementioned study was a longitudinal and is insightful to the current study as it has highlighted the relationship between executive function and reading

comprehension in German which is a developed country while the current study was a cross sectional and intended to establish the influence of executive function on reading comprehension among the Grade seven pupils in a Zambian context particularly in Itezhi-tezhi primary schools.

Pascale et al (2014) examined executive functioning and reading achievement in 106 6- to 8-year-old Brazilian children from a range of social backgrounds of whom approximately half lived below the poverty line. A particular focus was to explore the executive function profile of children whose classroom reading performance was judged below standard by their teachers and who were matched to controls on chronological age, sex, school type (private or public), domicile (Salvador/BA or São Paulo/SP) and socioeconomic status. Children completed a battery of 12 executive function tasks that were conceptual tapping cognitive flexibility, working memory, inhibition and selective attention. Each executive function domain was assessed by several tasks. Principal component analysis extracted four factors that were labelled “Working Memory/Cognitive Flexibility,” “Interference Suppression,” “Selective Attention,” and “Response Inhibition.” Individual differences in executive functioning components made differential contributions to early reading achievement. The Working Memory/Cognitive Flexibility factor emerged as the best predictor of reading. Group comparisons on computed factor scores showed that struggling readers displayed limitations in Working Memory/Cognitive Flexibility, but not in other executive function components, compared to more skilled readers. These results validate the account that working memory capacity provides a crucial building block for the development of early literacy skills and extends it to a population of early readers of Portuguese from Brazil. The study suggested that deficits in working memory/cognitive flexibility might represent one contributing factor to reading difficulties in early readers. This might have important implications for how educators might intervene with children at risk of academic under achievement. Pascale and others only included participants who were rated by their teachers as poor readers in both private and public schools, the current study gave all grade seven pupils at middle primary school level in public schools only to participate in a study which intended to establish the influence of executive function on reading comprehension in Zambia.

Cantin, Gnaedinger, Gallaway, Hesson-McInnis and Hund (2016) endeavoured to specify how executive functioning components predict reading, mathematics, and theory of mind performance during the elementary years in USA. Ninety-three 7- to 10-year-old children completed measures of working memory, inhibition, flexibility, reading, mathematics, and

theory of mind. Path analysis revealed that all three executive functioning components (working memory, inhibition, and flexibility) mediated age differences in reading comprehension, whereas age predicted mathematics and theory of mind directly. In addition, reading mediated the influence of executive functioning components on mathematics and theory of mind, except that flexibility also predicted mathematics directly. The findings provided important details about the development of executive functioning, reading, mathematics, and theory of mind during the elementary years. The above study by Cantin and others intended to specify how executive functioning components predict reading, mathematics, and theory of mind performance during the elementary years on a Ninety-three sample which consisted of 7- to 10-year-old children who completed measures of working memory, inhibition, flexibility, reading, mathematics, and theory of mind, the current study was restricted to the influence of executive function on reading comprehension among seventh graders only and not mathematics or theory of mind.

At Philadelphia College of Osteopathic Medicine (Kim, 2017) conducted a study on Executive Functions and Word Reading Fluency: A Brief Intervention with Economically Disadvantaged Secondary Students. The study evaluated the use of a brief intervention that was designed to assist economically disadvantaged secondary students increase their capacity for attention to orthography and increase their ability to shift between rapid sight word recognition and decoding of unknown words in order to improve their word reading accuracy and fluency. The participants (N = 14) were eighth and ninth grade students enrolled in an urban public high school and receiving special education services. The study used analysis of variance for repeated measures and paired measures t-tests to analyse pre- and post-test data. The results indicated significant findings ($p < 0.5$) in the students' improvements in their sight word reading fluency and their ability to inhibit impulses and shift cognitive sets with accuracy and speed following the 8-week reading intervention. The findings suggest that exposure to repeated word fluency drills that target attention to orthography and shifting from sight word recognition to decoding may have influenced the students' self-monitoring skills and offer further support regarding the hypothesized role of executive functions in the act of reading. The aforementioned study focused on Executive Functions and Word Reading Fluency at secondary school level among learners who were receiving special education, the current study was restricted to the influence of executive function on reading comprehension at grade seven primary school level among pupils receiving normal education.

Further, Lagattuta, Sayfan and Monsour (2011) carried out a study in United States of America on a new measure for assessing executive function across a wide age range. Two experiments examined 4 to 11 year olds' and adults' performance ($N = 350$) on two variants of a Stroop-like card task: the day-night task (say 'day' when shown a moon and 'night' when shown a sun) and a new happy-sad task (say 'happy' for a sad face and 'sad' for a happy face). Experiment 1 featured coloured cartoon drawings. In Experiment 2, the happy-sad task featured photographs, and pictures for both measures were grayscale. All age groups made more errors and took longer to respond to the happy-sad versus the day-night versions. Unlike the day-night task, the happy-sad task did not suffer from ceiling effects, even in adults. The happy-sad task provides a methodological advance for measuring executive function across a wide age range. The above Study used a 350 sample consisting of children and adults and focussed on a new measure for assessing executive function across a wide age range, the current study endeavoured to explore the influence of executive function on reading comprehension on a sample of 120 of seven graders at middle primary level in Zambia.

Iglesias-Sarmiento, López, and Rodríguez (2015) carried out a study in urban school in Ourense (Spain) on Updating executive function and performance in reading comprehension and problem solving. the study investigated the capacity of the working memory (WM) updating executive function to predict individual differences in reading comprehension and problem solving was analysed in 5th-graders of Primary Education. In addition, we examined whether this relation is direct or mediated by domain-general or domain-specific variables. For this purpose, a series of tasks was administered to assess fluid intelligence, WM information updating, arithmetic abilities, arithmetic problem solving, lexical processing, and reading comprehension in 49 students aged between 10 and 11 years. The results support the idea that updating is an important predictor of reading comprehension, beyond the influence of domain specific skills and fluid intelligence. In the case of problem solving, our findings confirm that updating plays an important role although, perhaps due to task content, the relation seems to be mediated by fluid intelligence at this developmental stage. The above study was conducted in urban areas of Spain, a developed country and focused on updating executive function and performance in reading comprehension and problem solving, it's not known whether the same findings were going to be found in the current study which was done in Itezhi-tezhi which is a rural District in a developing Country like Zambia.

Kamza (2017) conducted a study in Poland on developmental patterns of relationships between inhibitory control and reading skill in early school children. The study found that Inhibitory

control is one of the most important components of executive functions, which allows to suppress or regulate attentional or behavioural responses. It was proved to be a crucial factor for school achievement, including math abilities and reading acquisition. The study was a cross-sectional study of Ober's assumptions about the developmental patterns of relationships between inhibitory control and reading skill were examined. The sample consisted of 256 grade 1-3 primary school children. Decoding and comprehension, the two subcomponents of reading skill, were assessed using Prolexia Test, while cognitive inhibitory control was measured with the Color Word Stroop Task. Simple correlation analyses showed that comprehension ability was related to inhibitory control but only among boys from 1st and 2nd grades (but not among 3rd graders), and no relations between reading subcomponents and inhibitory control were found among girls. However, hierarchical regression analyses controlling for other reading subcomponent did not yield a significant effect of interaction. Instead, it was found that inhibitory control was related to reading only in the 1st graders. Also, some gender differences between 1st and 2nd graders in their reading ability were observed. Those findings suggest that although gender plays a significant role in reading skill development of early school children, it does not moderate the developmental links between inhibitory control and reading skill. Kamza's study focused on developmental patterns of relationships between inhibitory control and reading skill in early school children from grade 1 to 3 while the current study focused on the influence of executive function on reading comprehension at grade seven primary school level in Zambia.

A study by Best (2010) in two private schools in Victoria, British Columbia on the Contribution of Working Memory Components to Reading Comprehension in Children. The study examined language, memory and reading skills in children from. Phonological processing and word-level decoding were significantly correlated, suggesting that familiarity with letters and their associated sounds are important for word-level reading. Phonological processing and decoding skill performance were significantly correlated with STM span and not WM span, suggesting that word-level decoding is not attentionally demanding for this sample of children. Decoding speed was inversely related to STM span; faster reading times and larger STM spans were highly predictive of one another. The children's WM and STM task performance were relatively similar and may be reflective of efficient strategy use, such as word recognition, which reduces attention for processing in WM. The study by Best was conducted in two private Schools in Columbia, while the current study was conducted in 6 public primary schools in Zambia.

Butterfus and Kandeou (2018) conducted a study at University of Minnesota in USA on the role of executive function on reading comprehension. The goal of the study is to understand the extent to which, and under what conditions, executive functions (EFs) play a role in reading comprehension processes. The study begun with a brief review of core components of EF (inhibition, shifting, and updating) and reading comprehension. The study further discussed the status of EFs in process models of reading comprehension. Finally, the study reviewed and synthesized empirical evidence in the extant literature for the involvement of core components of EF in reading comprehension processes under different reading conditions and across different populations. The study concluded that EFs may help explain complex interactions between the reader, the text, and the discourse situation, and call for both existing and future models of reading comprehension to include EFs as explicit components. The study by Butterfus and Kandeou is insightful to the current study as it has highlighted the role of executive function on reading comprehension in the United States of America which is a developed country while the current study looked at the influence of executive function on reading comprehension among the Grade seven pupils in rural primary schools in Zambia which is developing Country.

Cartwright, Marshall, Daddy and Isaac (2010) did a study in Howick, London on development of graph phonological-semantic cognitive flexibility and its contribution to reading comprehension in beginning readers. Reading-specific and general colour-shape cognitive flexibility were assessed in 68 first and second graders to examine: 1) the development of graph phonological-semantic cognitive flexibility (the ability to process concurrently phonological and semantic aspects of print) in comparison to colour-shape cognitive flexibility, 2) the contribution of reading experience to graph phonological-semantic flexibility, and 3) the unique contribution of graph phonological-semantic flexibility to reading comprehension. Second graders scored significantly higher than first graders on both cognitive flexibility tasks; the general flexibility task was easier for all children than the graph phonological-semantic flexibility task; reading experience contributed uniquely to children's graph phonological-semantic flexibility; and graph phonological-semantic flexibility contributed significant, unique variance to children's reading comprehension. The current study intended to establish the influence of executive function on reading comprehension among the Grade seven in Zambia particularly in Itezhi-tezhi primary schools and differs with the study by Cartwright and others which focused on development of graph phonological-semantic cognitive flexibility and its contribution to reading comprehension in beginning readers at first and second graders.

Chiappe, Linda, Siegel and Hasher (2000) carried out study in Columbia on Working memory, inhibitory control, and reading disability. The relationships among working memory, inhibitory control, and reading skills were studied in 966 individuals, 6-49 years old. In addition to a standardized measure of word recognition, they received a working memory (listening span) task in the standard, blocked format (three sets containing two-, three-, or four-item trials) or in a mixed format (three sets each containing two-, three-, and four-item trials) to determine whether scores derived from the standard format are influenced by proactive interference. Intrusion errors were investigated in order to determine whether deficits in working memory were associated with the access, deletion, or restraint functions of inhibitory control. The results indicated that deficits in working memory were characteristic of individuals with reading disabilities at all ages. These deficits may be associated with the access and restraint functions of inhibition. Working memory skills increased until the age of 19. The blocked format showed a gradual decline in adulthood whereas the mixed format did not. The different patterns suggest that the decline in working memory skills associated with aging may result from growing inefficiencies in inhibitory control, and not diminished capacity. The study by Chiappe and others focused on working memory, inhibitory control, and reading disability on participants aged 6 to 49, the current study focused on the influence of executive function on reading comprehension among Grade sevens learners and excluded adults.

John, Claudine, Margaret and Slowling (1999) conducted a study in Hestington, United Kingdom on Working Memory Deficits in Poor Comprehenders Reflect Underlying Language Impairments. Three experiments assessed memory skills in good and poor comprehenders, matched for decoding skill. Experiments 1 and 2 investigated phonological and semantic contributions to short-term memory by comparing serial recall for words varying in length, lexicality, and concreteness. Poor comprehenders showed normal sensitivity to phonological manipulations (length and lexicality) but, consistent with their semantic weaknesses, their recall of abstract words was poor. Experiment 3 investigated verbal and spatial working memory. While poor comprehenders achieved normal spatial spans, their verbal spans were impaired. These results are discussed within a theoretical framework in which the memory difficulties associated with poor reading comprehension are specific to the verbal domain and are a concomitant of language impairment, rather than a cause of reading comprehension failure. The study by John, Claudine, Margaret and Slowling focused on Working Memory Deficits in Poor Comprehenders with Language Impairments, the current study intended to

establish the influence of executive function on reading comprehension among the Grade seven learners in Zambian Primary schools.

A study conducted in Canada by Basco (2016) on the role of executive function in children's communication repair. The study examined the impact of listener feedback and children's executive functioning in influencing children's ability to repair their messages. Further, this work explored whether the cognitive demands of repair differed depending on the type of feedback provided by the listener. Children (ages 4 to 6) completed a referential communication task, in which they described target pictures amongst an array of similar distractors for a confederate. Stimuli were designed such that children would often provide initially ambiguous referential statements. Subsequently they were provided with feedback from the confederate indicating they had been misunderstood. Feedback was either detailed and specified the nature of the miscommunication, or was vague and did not. Children also completed executive functioning tasks assessing their working memory, inhibitory control, and cognitive flexibility. Children with larger working memory capacities and better cognitive flexibility were found to provide more effective initial descriptions of the target pictures. Children with better cognitive flexibility were also more effective at repairing their statements in response to feedback indicating they had been misunderstood. While children provided more effective repairs following detailed feedback than vague feedback, this effect did not interact with the cognitive skills of the children. The aforementioned study differs from the current study as it focused on the role of executive function in children's communication repair while the current study gave an insight on the influence of executive function on reading comprehension among seventh graders at middle primary school level in Itezhi-tezhi District, Zambia.

Barkley (2012) did a study in California on roles of executive functioning and self-regulation in Attention Deficit Hyperactivity Disorder (ADHD). The study revealed that parents and educators dealing with children or adults with ADHD are likely to have heard increasing references to the terms "executive functioning" (EF) and "self-regulation" over the past few years. Numerous books on this topic have appeared during that time along with hundreds of scientific papers focusing on the relationship between these constructs, or ideas, and ADHD. One often hears that ADHD is a disorder of EF or that ADHD involves poor self-regulation. But what does this mean? How are these terms related to each other and to ADHD? Does this have some impact on the way in which one should manage the disorder? The purpose of this guest column is to give a brief overview of these terms and what their involvement in ADHD

may mean for understanding its nature and also for planning interventions for those who have the disorder. The current study intended to ascertain the influence of executive function on reading comprehension among seventh graders in Itezhi-tezhi District and differs from Barkley's study as it used children with Attention Deficit Hyperactivity Disorder (ADHD) to investigate the most sensitive construct of executive function.

Cain (2006) did a study in Howick, London on Individual differences in children's memory and reading comprehension: An investigation of semantic and inhibitory deficits. Three experiments compared the verbal memory skills of children with poor reading comprehension with that of same-age good comprehenders. The aims were to determine if semantic and/or inhibitory deficits explained comprehenders' problems on measures of verbal short-term memory and verbal working memory. In Experiment 1 there were no group differences on word- and number-based measures of short-term storage and no evidence that semantic knowledge mediated word recall. In Experiment 2 poor comprehenders were impaired on word- and number-based assessments of working memory, the greatest deficit found on the word-based task. Error analysis of both word-based tasks revealed that poor comprehenders were more likely to recall items that should have been inhibited than were good comprehenders. Experiment 3 extended this finding: Poor comprehenders were less able to inhibit information that was no longer relevant. Together, these findings suggest that individual differences in inhibitory processing influence the ability to regulate the contents of working memory, which may contribute to the differential memory performance of good and poor comprehenders. The current study assessed the influence of executive function on reading comprehension among seventh graders at middle primary school level and differs with Cain's study as it focused on individual differences in children's memory and reading comprehension by investigating semantic and inhibitory deficits.

2.4 African related Literature on Executive functioning and reading comprehension

Some African scholars have acknowledged the positive contribution of executive function on academic achievement and reading. (Wolf and McCoy, 2019, Esopo, 2018, Willoughby et al, 2017, Jager and Condry, 2017, Osuji, 2017, Spaull and Pretorius, 2014, Veei, 2003).

A study done in Ghana by Wolf and McCoy (2019) on the role of executive function and social-emotional skills in the development of literacy and numeracy during preschool: a cross-lagged longitudinal study. A sample size of 3,862 was assessed using direct assessment at three time points over the course of two school years. After controlling for earlier levels of the same skill,

findings of the study indicated that early executive function predicted higher subsequent literacy and numeracy skills, and early literacy and numeracy skills predicted higher subsequent executive function, indicating that the development of executive function and academic skills is inter-related and complementary over time. Early literacy and numeracy predicted subsequent social-emotional skills, but early social-emotional skills did not predict subsequent literacy and numeracy skills. The current study was a cross sectional with a sample size of 120 and intended to give an insight on the influence of executive function on reading comprehension among the Grade seven learners at public primary school level in Itezhi-tezhi and differs with the study by Wolf and McCoy which was longitudinal and used a sample size of 3,862 and focused on the role of executive function and social-emotional skills in the development of literacy and numeracy during preschool in Ghana.

Willoughby et al (2017) did a study in Kenya on measuring executive function skills in young children in Kenya. The study used a sample size of 193 children and findings indicated that Children had poor executive function skills. Willoughby and others focused on measuring executive function skills in young children in Kenya and did not focus on the influence of executive function on reading comprehension among seventh graders in public primary schools which the current study did.

In Nigeria, a study by Osuji (2017) on Cognitive and metacognitive strategy use in first and second language reading comprehension, explored cognitive and metacognitive strategy use in first and second language reading comprehension (RC) among Igbo native speakers who are English as Second Language (ESL) learners. Three studies were analysed. Exploring cognitive and metacognitive strategy use in RC performance in Igbo (study 1), the effect of L2 language proficiency and vocabulary size on the use of cognitive and metacognitive strategies in ESL reading (study 2), and the effect of cognitive and metacognitive strategy use on ESL RC (study 3), respectively. To explore cognitive and metacognitive strategy use on first language RC performance (study 1), participants did RC tasks in Igbo and completed a reading comprehension strategies (RCSs) questionnaire. Regression analysis suggested that their RC strategy use explained a significant variance (28.6%) in the Igbo reading scores of the students. No significant difference was recorded in the participants' reported use of cognitive and metacognitive strategies during the reading task. In study 2, in addition to doing RC tasks in English and completing RCSs questionnaire, participants sat English language proficiency and vocabulary size tests. High vocabulary size was significantly related to high use of cognitive reading strategies, while low vocabulary size was related to low use of cognitive reading

strategies. L2 language proficiency had no effect on RCS use, and reading comprehension strategy use had no effect on RC performance. In study 3, participants did another set of reading tasks and completed a RCSs questionnaire. Cognitive and metacognitive strategy use jointly had a significant positive effect on RC performance, but only metacognitive strategy uses uniquely contributed significantly to RC performance. The usage levels for cognitive and metacognitive strategies distinguished high performers from low performers in the RC test, but the cognitive strategy of translation was hardly used by this group of ESL readers. Osuji's study focused on cognitive and metacognitive strategy used in first and second language reading comprehension (RC) among Igbo native speakers who use English as Second Language (ESL) learners in Nigeria, the current study focused on the influence of executive function on reading comprehension among Zambian seventh graders.

Esterhuizen and Grosser (2014) in Johannesburg endeavoured to explore ways of improving some cognitive functions, specifically executive functions in grade R learners. The study established the effects of a researcher-developed curriculum-based intervention programme. The intervention was grounded on principles of Feuerstein's ideas about 'mediated learning'. The study selected a group of South African Grade R learners ($n = 20$). A quasi-experimental design was employed to collect quantitative data on rotational basis from experimental groups A and B, by means of dynamic assessment with the Children's Inferential Thinking Modifiability (CITM) test during pre-test, post-test and delayed post-test occasions. The test data was intended to elicit the extent to which the intervention that had focused on enhancing executive functions had contributed to the participants' application of cognitive and metacognitive skills and strategies. Qualitative data captured participants' application of cognitive processes in the input, elaboration, and output phases of the designed learning process, as well as the characteristics of their inhibitory control functions. A striking finding was the improvement noted in the children's application of the following executive functions, namely working memory, cognitive flexibility and inhibitory control. The current study explored the influence of executive function on reading comprehension among seventh graders in Itezhi-tezhi District and differs with Esterhuizen and Grosser's study which focused on improving some cognitive functions, specifically executive functions in grade R learners.

Staden and Bosker (2014) conducted a study in South Africa on Factors that affect South African Reading Literacy Achievement: Evidence from prePIRLS 2011. The study draws on the preProgress in International Reading Literacy Study (prePIRLS) 2011 data, which placed South African Grade 4 learners' results substantially below the international centre point of

500 at 461 (SE = 3.7). Selected items from the prePIRLS 2011 learner, parent and teacher questionnaires were used in a two-level model to determine the effect of learner aptitude, opportunity to learn and quality of instructional events on reading literacy achievement. The findings indicated a statistical significance of engaged reading and cultivating motivation for reading among learners from an early age, specifically through parental involvement in introducing early literacy activities as foundation of reading literacy by school-going age. Further, the study indicated evidence for importance of the value of reading across the curriculum not confined to formal reading lessons only. The teaching of reading comprehension skills and strategies was identified as a significant predictor of reading literacy achievement. The aforementioned study used document analysis by using secondary data generated by International Reading Literacy Study (prePIRLS) of 2011, which places South African Grade 4 learners' results substantially below the international centre point of 500 at 461 (SE = 3.7). The study never investigated the influence of executive function of reading comprehension but only focused on exploring factors that affect South African Reading Literacy Achievement, the current study used primary data and focused on the influence of executive function on reading comprehension among Zambian seventh graders.

A South African study by Aunio, Korhonen, Ragpot, Törmänen, Mononen and Henning, (2010) on Multi-factorial approach to early numeracy: The effects of cognitive skills, language factors and kindergarten attendance on early numeracy performance of South African first graders. The findings on Structural equation path models showed that kindergarten attendance predicted children's early numeracy performance even when controlling for executive function and language skills. Listening comprehension skills predicted the early numeracy skills more strongly than did executive function skills. ESL was associated with weaker early numeracy performance. While the study by Aunio and others focused on Multi-factorial approach to early numeracy by assessing effects of cognitive skills, language factors and kindergarten attendance on early numeracy performance of South African first graders, the current study focused on the influence of executive function on reading comprehension among the seventh graders in public primary schools in Itezhi-tezhi, Zambia.

Esopo (2018) did a study on measuring self-efficacy, executive function, and temporal discounting in Kenya. In the study, it adapted psychological scales and behavioral tasks, measuring each of these three constructs, for use among adults in Kenya. The study translated and back-translated each measure to Kiswahili and conducted cognitive interviewing to establish cultural acceptability, refined existing behavioral tasks, and developed new ones. The

study found relatively low reliability and poor correlational evidence between psychological scales and behavioral tasks measuring the same construct, highlighting the challenges of adapting measures across cultures, and suggested that assays within the same domain may tap distinct underlying processes. The above study on measuring self-efficacy, executive function, and temporal discounting was conducted in a Medical context in Kenya, the current study explored the influence of executive function on reading comprehension among Zambian seventh graders in an educational context.

Humphreys et al (2017) conducted a study on Cognitive Function in Low-Income and Low-Literacy Settings: Validation of the Tablet-Based Oxford Cognitive Screen in the Health and Aging in Africa. The study used a sample of 1,402 men and women aged 40–79. The study administered OCS-Plus along with health and socio demographic assessments. HAALSI is a representative sample of older adults in Agincourt, South Africa contributing to normative understanding of cognition in LMIC. The study indicated construct and external validity of the OCS-Plus. The Results further showed that OCS-Plus had excellent construct and external validity. Intra-class correlations between similar basic measures of orientation in OCS-Plus and in HAALSI assessments was 0.79, and groups of people performing well on the OCS-Plus verbal memory also showed superior performance on HAALSI verbal memory. The OCS-Plus scores showed consistent associations with age and education and domain-specific associations with alcohol and depression. Younger respondents and the more educated did better on all assessments. Humphreys and others focused on Cognitive Function in Low-Income and Low-Literacy Settings by validating the Tablet-Based Oxford Cognitive Screen in the Health context, the current study explored the influence of executive function on reading comprehension among seventh graders in Ministry of General Education in Zambia.

A study by Maswikiti (2005) on the Influence of Socioeconomic Status and quality of education on School Children's Academic Performance in South Africa. Participants were 79 children between the ages of 12 and 15 years from various Cape Town schools. The sample included children from both high and low SES families, and with varying qualities of education. The most meaningful measure of SES was the average income for the area in which the child lived or was educated (as articulated in the latest Census). Quality of education was estimated based on whether the school was previously disadvantaged or previously advantaged. The child's general intellectual functioning was measured using the Wechsler Abbreviated Scale of Intelligence (WASI) while academic achievement was measured using the two most

recent school reports. The findings showed that children from high SES families and with a high quality of education scored better on the WASI than did children from low SES families and with a low quality of education. The study further revealed an interesting interaction between SES and quality of education: Participants from low SES families but with a high quality of education scored significantly better on WASI performance IQ measures than did participants from low SES families and with a low quality of education. These findings suggest that children from low SES families in South Africa might be at a grave disadvantage in terms of their ability to succeed academically, but that quality of education might be a more important factor than SES in determining levels of general intellectual functioning. The current study explored the influence of executive function on reading comprehension among Zambian seventh graders in Ministry of General Education in Itezhi-tezhi District while Maswikiti's study focused on the Influence of Socioeconomic Status and quality of education on School Children's Academic Performance in South Africa.

A study in Johannesburg by Fitzpatrick (2014) on bridging the gap between advantaged and disadvantaged children: Why should we be concerned with executive functions in the South African context? The study found that although math and reading skills were important predictors of later achievement, executive function skills underlie children's ability to focus attention and become autonomous, self-directed learners. The study further indicated that play executive function plays a key role in later adjustment and better academic performance and disadvantaged children perform more poorly on tests of achievement and executive functions. Furthermore, the findings showed that executive function has been found to partially account for the relationship between socioeconomic status and later achievement. Fitzpatrick's study focused on bridging the gap between advantaged and disadvantaged children by investigating reason why South African should be concerned with the executive functions of advantaged and disadvantaged children, the current study intended to establish the influence of executive function on reading comprehension among Zambian seventh graders in Itezhi-tezhi District.

A study done in Namibia by Vei (2003) on Cognitive and linguistic predictors of literacy in Namibian Herero- English bilingual school children assessed two conflicting viewpoints regarding the development of literacy amongst bilingual children: the central processing and script dependent hypotheses. It was a cross-sectional study which tested the reading and spelling ability of Grades 2-5 Herero/English bilingual children in Namibia and investigated possible predictors of literacy among measures of cognitive/linguistic processes. The findings indicated that children showed evidence of acquiring Herero (L1) literacy skills faster than the

same skills in English (L2), while at the same time there was evidence for underlying cognitive/linguistic predictors of literacy ability in both languages. The results further showed that literacy in both languages could be reliably predicted by L1 listening comprehension and L2 phonological awareness. A second study provided a longitudinal perspective on the gains in literacy made by a subset of the cohort over a one-year period, similarly, the results were consistent with faster gains in Herero literacy development and there was evidence for similar underlying cognitive/linguistic predictors of literacy skills achieved in both Herero and English. The study further found that phonological skills influenced literacy development in both languages. The above study focused on Cognitive and linguistic predictors of literacy in Namibian Herero- English bilingual school children, the current study explored the influence of executive function on reading comprehension among seventh graders in Ministry of General Education in Itezhi-tezhi District, Zambia.

A study done in South Africa by Jager and Condry (2017) on the influence of executive function challenges on the behavioural adaptation of one learner with autism spectrum disorder. An interpretive case study approach was followed to help understand one unique ASD learner and explain the complexity of the behavioural adaptation challenges that he was experiencing. Observations and an interview were used as data collection methods. The results of the study indicated that Learner T experienced EF challenges and without acquiring and implementing appropriate EF skills, he found it difficult to exhibit appropriate social behaviour in the inclusive learning environment. The current study was a quantitative study and employed quasi-experimental research design while the study by Jager and Condry was qualitative and used a case study research design.

2.5 Zambian related literature on Executive functioning and reading comprehension

Some studies done in Zambia in the area of executive function have shown the importance of the relationship between executive functioning, literacy and numeracy attainment at lower primary school levels. (Kalumba, 2017; Mwanza-Kabaghe, 2015; Mwanza-Kabaghe, et al. 2015; Mubanga, 2015). For instance, a local study by Mwanza-Kabaghe (2015) in Zambia on Preschool, Executive Functions and Oral Language as Predictors of Literacy and Numeracy Skills in First Grade revealed that pupils who went to preschool did not outperform pupils who did not go to preschool in first grade. In terms of executive functions, the study revealed that executive functions did predict literacy and numeracy skills. Specifically, working memory and inhibitory control predicted literacy and numeracy skills over and above other executive

functions. However, preschool did not promote executive functions but, it was established that executive functions are better predictors of numeracy than literacy. This was also supported by Mbewe, Matafwali and Mwanza-Kabaghe (2016). Mwanza-Kabaghe's study differed from the current study as it concentrated on Preschool, Executive Functions and Oral Language as Predictors of Literacy and Numeracy Skills in First Grade. The current study focused on the influence of executive function on reading comprehension among seventh graders at middle primary school level in Itezhi-tezhi District.

Similarly, Kalumba (2017) conducted a study in Lusaka which examined the role of executive functioning in numeracy attainment in the second grade did not show an association between the overall executive functioning but (individual) and numeracy in the second grade. The findings further established that demographic factors such as age, gender and location of schools were associated with executive functioning. However, the study found that the general performance in mathematics was good. The location was Similar and did not differ in performance whether children came from Low, medium and high density schools. Finally, the study concluded that numeracy attainment is associated to planning and organisation and working memory. While the study by Kalumba focused on the role of executive functioning in early numeracy attainment by second graders, the current study was restricted to the influence of executive function on reading comprehension among seventh graders at middle primary school level and not early numeracy attainment.

Another local study by Mulenga (2017) on establishment of the grade four learners' ability in reading appropriately phonic and sight words in English language in Lusaka found that that grade four learners were able to identify the letters of the English alphabet by their sounds. The study further revealed that learners were able to read sight words at a slow pace and pronunciation was not consistent in most learners. The study also established that teachers faced challenges when teaching reading phonic and sight words in English language as evidenced from the themes that emerged. However, Mulenga used qualitative method and never incorporated the aspect of executive function but just focused on the establishment of grade four learners' ability in reading appropriate phonic and sight words in English language in schools in Lusaka, the current study was quantitative and focused on the influence of executive function on reading comprehension among seventh graders at middle primary school level in Itezhi-tezhi District.

Mubanga (2015) carried out a study on differential effects of child-characteristics on early literacy and numeracy skill-attainment in selected low and high performing Schools in Northern Province of Zambia and found that there were low literacy and numeracy attainment levels among children with high stress reactivity in schools with poor didactics, and high literacy and numeracy attainment levels among children with low stress level reactivity in schools with poor didactics. The study further found that low SES and deprived home environments elevated levels of stress reactivity whereas high SES suppressed stress reactivity as the influence of biological sensitivity is dependent on either the positive or negative settings. Surprisingly, pre-school, home literacy and home learning support were not strong predictors of literacy and numeracy skills, except for alphabet knowledge. The study by Mubanga differed from the current study as it used executive function as a background variable and concentrated on differential effects of child-characteristics on early literacy and numeracy skill-attainment (in the first grade) while the current study used executive functioning as a main independent variable to determine its influence on reading comprehension among seventh graders at middle primary school level in Itezhi-tezhi District, Zambia.

Chansa-Kabali (2014) carried out a study on acquisition of early reading skills: the influence of the home environment in Lusaka District and found that children's home environments were experienced differently and significantly impacted children's reading skills. These home environment factors included family possessions (electricity, stove, television, running water, flushable toilet and a car). The study also showed that parental reading attitudes significantly explained variation in children's reading skills. Parents who favourably ascribed to reading as an important activity in the home had children performing better on reading skills. Further, results showed that reading materials predicted orthographic awareness and not decoding. Although results based on parents' and teachers' views revealed weak home-school relations, it was found that affirmative parental views on the school positively impacted children's scores on the reading outcomes. Further, qualitative inquiry confirmed that high achieving learners experienced a more literate home environment than low achieving learners. The current study focused on the influence of executive function on reading comprehension among seventh graders at middle primary school level in Itezhi-tezhi District different from the study by Chansa-Kabali which never incorporated the aspect of executive function but only focused on the influence of the home environment on acquisition of early reading skills.

Another study by Chirwa (2012) on the effect of quality of education on neuropsychological test performance among Zambian adults and demonstrated that that verbal episodic memory tests, of the participants' quality of learning predicted 15.3% of the study participants' test performance and on verbal fluency tests the predictive powers of the participants' quality of learning was 34.5%. The study revealed that speed of information processing tests predictive value was 24.9% and on executive function tests, the predicted value was 22.0%. For attention/working memory tests quality of learning had a predictive value of 18.1% while on motor tests it predicted 15.6% of the participants' test performance at a statistical significance level of $p < .05$. On all the tests, quality of learning predicted 27.8% of the participants' test performance at a statistical significance level of $p < .05$. The participants' quality of teachers had a statistically significant on verbal memory tests with a predictive power of 12.5% ($p < .05$). Upon analysing the effect of quality of school it was found that on the verbal fluency tests the predictive powers of the participants' quality of school was 16.7% at a statistical significance level of $p < .05$ as shown in table 4.4. While the aforementioned study focused on the effect of quality of education on neuropsychological test performance among Zambian adults in hospitals and clinics in Lusaka, the current study concentrated on the influence of executive function on reading comprehension among seventh graders at middle primary school level in Ministry of General Education.

Mutale (2013) conducted a study entitled challenges faced by grade twelve learners in reading comprehension and found that grade twelve learners faced challenges in reading comprehension. Grade 12 learners were unable to approach written texts actively in order to interact with the texts. They were not able to set specific goals for reading and had challenges with word meanings resulting in the inability to make connections of new vocabulary to prior knowledge. Further, the study found that when comprehension was administered, learners were only able to monitor their comprehension using the clarifying strategy which is only one of the monitoring strategies used to repair comprehension breakdown. Findings also indicated that teachers were inconsistent in their use of strategies that helped learners activate their prior knowledge. The study by Mulenga differed with the current study because it was conducted at senior secondary school level among grade twelve learners in Kafue District and mainly focussed on challenges faced by grade twelve learners in reading comprehension without considering the aspect of executive functions while the current study focused on the influence of executive function on reading comprehension among seventh graders at middle primary school level in Itezhi-tezhi District

A study by Nkosha (2011) entitled effects of the discourse analysis strategy and the conventional approach on pupils' performance in reading comprehension in Bemba, found that there was statistically significant difference between the post-test mean scores of the experimental group¹ and the control group. Although there was no significant difference (statistically!) between the performance of the two groups. The study further revealed that subjects' individual post-test scores revealed that there was a small positive tendency for the discourse analysis group to do slightly better than the conventional approach group. The current study focused on the influence of executive function on reading comprehension among seventh graders at middle primary school level in Itzhi-tezhi District and differed from Nkosha's study which was conducted among eleventh graders and focussed on effects of the discourse analysis strategy and the conventional approach on pupils' performance in reading comprehension in Bemba.

Chazangwe (2011) endeavoured to investigate factors for poor performance of grade twelve pupils in reading comprehension in Kalomo District and revealed that teachers found it difficult to teach reading comprehension. The study further revealed that teaching reading comprehension was difficult because it was time consuming and the quality of pupils did not even understand certain concepts used in reading comprehension passages. The study also found that poor performance of grade twelve pupils in reading comprehension was caused by poor reading culture among pupils. The study by Chazangwe differed from the current study as it only focused on investigating the factors causing poor performance of grade twelve pupils in reading comprehension and never incorporated the aspect of the influence of executive function on reading comprehension.

A study by Tambulukani (2015) on first language teaching of initial reading: blessing or curse for the Zambian children under primary reading programme and found that that oral-language plays major roles in initial reading especially when beginning readers have acquired a minimum of alphabetic understanding that enables word reading and writing. The results also confirmed that transfer of skills from the first language to the second language was evident for the learners who had acquired initial reading ability in the first language. The relatively slow development even of the highest performing pupils may indicate that the learning process does not tune to children's prior experiences with language and literacy. The study by Tambulukani never incorporated the aspect of executive function but just focused on first language teaching of initial reading whether it was a blessing or curse for the Zambian children under primary reading programme at lower primary school level, the current study explicitly focused on the

influence of executive functioning on reading comprehension among seventh graders at middle primary school level in Iteshi-tezhi District.

Matafwali (2011) endeavoured to investigate the nature and prevalence of reading difficulties in the third grade of Lusaka rural and urban schools. A number of instruments were used to measure requisites and correlates of reading skills. Subtests from the screening instrument known as the Basic Skill Assessment Tool (BASAT) provided most of the individual measures of reading skills. Included among these measures were: the alphabetic principle, phonological awareness, working memory, and reading comprehension. Results suggest that, only a small proportion of children were able to read at a comfortable grade level. Performance was found to be generally poor with no significant difference between the rural and urban schools. As expected, the subtests related to reading skills were significantly correlated. Digit Span, a test of working memory, correlated with letter recognition ($r = .30, p < .01$), letter-sound knowledge ($r = .22, p < .05$), word reading ($r = .24, p < .05$), and serial rapid naming of numbers ($r = .33, p < .01$). The study by Matafwali only focused on investigating the nature and prevalence of reading difficulties among third graders at lower primary school level and never endeavoured to give an insight on how executive functioning influences reading comprehension. The current study endeavoured to establish the influence of executive functioning on reading comprehension among seventh graders at middle primary school level in Iteshi-tezhi District.

A study done in Zambia by McCoy et al (2017) on Early Childhood Care and School Readiness in Zambia. The study revealed that despite increased investment in early childhood care and education (ECCE) globally, little is known about its effectiveness in low-income countries. Using kernel exact matching within a national sample of 1,623 Zambian 6-year-olds. The study tested the associations between ECCE participation and seven domains of children's school readiness. The study found ECCE participation to be significantly and positively predictive of children's receptive vocabulary, letter naming, reasoning, fine motor, executive function, and task performance skills ($d = 0.20 - 0.65$). Although ECCE predicted better outcomes across program types and dosage levels, associations between ECCE participation and school readiness were descriptively if not significantly larger for children attending non-profit (versus governmental or private) programs and for those attending ECCE between three and five hours per day (versus those attending less than three or six or more hours per day). The aforementioned study focused on Early Childhood Care and School Readiness in Zambia and never investigated the influence of executive function on reading comprehension among

seventh graders. The current study targeted to establish how executive functioning influences reading comprehension among seventh graders at middle primary school level in Itezhi-tezhi District.

Mwanza-Kabaghe, Mubanga, Matafwali, Kasonde-Ng'andu and Bus (2015) conducted a study on the link between pre-school, executive function and literacy performance among first graders in Lusaka. A total of 216 children including 118 with a pre-school background were tested at the start of first grade and again approximately eight months later. The basic skills assessment tool for reading and writing (BASAT) was applied at both measurements to assess literacy while the executive functions were assessed using the pencil tapping test, Stoop-like Test and the behaviour inventory for executives (BRIEF). Basic skills at the start of the first grade were better when children had been to pre-school but did not predict academic success in first grade. Multilevel regression analysis revealed that executive functions do predict literacy skills. Specifically, working memory and inhibitory control predict literacy skills over and above other executive functions. However, pre-school did not promote executive functions. The study further revealed that oral language is important for performance in literacy skill. While the study by Mwanza-Kabaghe and others concentrated on the link between pre-school, executive function and literacy performance among first graders with a total sample size of 216 of which 118 had a pre-school background and were exposed to the basic skills assessment tools to measure literacy levels in Lusaka District, the current study focused on the relationship between executive function and reading comprehension using Reading Comprehension Assessment Battery with a total sample size of 216 comprising 108 seventh graders with or without pre-school background at middle primary school level in Itezhi-tezhi District, Zambia.

2.6 Summary of the chapter

The chapter reviewed related literature in regard to the proposed study on the influence of executive function on reading comprehension. The chapter started with development perspective of executive function and further reviewed literature from Global perspective with regard to executive functioning and reading comprehension. The review of related studies further captured the African perspective on executive functioning and reading comprehension and ended with the Zambian perspective where a number of local studies in an area of executive functioning and reading were interrogated to come up with a knowledge gap which gave this study an impetus to inquire and address the influence of executive functioning on reading

comprehension among grade seven pupils in selected primary schools in Itezhi-tezhi District. The next chapter presents research methodology that guided the study.

CHAPTER THREE: METHODOLOGY

3.1 Overview

The previous chapter gave a review of some important literature on the influence of executive function on reading comprehension. The current chapter presents the methodology used in the study which included the philosophical assumption, research design, and target population, sample size and sampling techniques, research instruments, validity and reliability of instruments, data collection procedure, data analysis and ethical considerations.

3.2. Philosophical Paradigm

A philosophical paradigm is a fundamental set of beliefs or worldview that guides research action (Denzin and Lincoln, 2000). Positivist paradigm is among other paradigms that are used in studies and is based on the assumption that a single tangible reality exists and it must be one that can be understood, identified, and measured. The current study utilised a positivist paradigm which allows explanation and prediction in a causal framework (Varpio and MacLeod, 2020). Positivists further contend that knowledge can and must be developed objectively without the values of the researchers or participants influencing its development. (Shadish, Cook and Campbell, 2001). Positivist methodology emphasizes engaging in research in settings where variables can be controlled and manipulated (Cambell and Stanley, 1963). In the social sciences, this requires that the researcher creates somewhat artificial environments where other extraneous factors beyond the study variables are minimized (Varpio and MacLeod, 2020). In the purest form of positivism, the sole focus of the study is to examine the explanatory or causal relationships between variables in the study, as is done in the natural sciences in which experimental designs are favoured including quasi-experimental design. Therefore, the appropriateness of this philosophy was based on the premise to allow explanation and prediction in a correlational framework that operate naturally, elements which the current study is anchored and grounded upon as it sought to determine the influence of executive function on reading comprehension among the seventh graders.

3.3. Research Design

The study employed a quantitative research approach and utilised a quasi-experimental research design. A quasi- experimental research design has no characteristics of a true experiment. (Creswell and Creswell, 2018). Quasi- experimental research design is non-interventional in nature as no active intervention is injected in a study because only the

dependent variable is manipulated to serve as an intervention. (Sahaya and selvam, 2017; Haslan and McGarty, 2014). In this study, a quasi- experimental research design was selected because the study was non-interventional as the researcher observed variables and analyzed them without injecting an intervention. This research design was appropriate for the current study as it intended to give an insight on the influence of executive functioning on reading comprehension without manipulating the participants and by collecting data within the school and home environments which were natural setting in Itezhi-tezhi District.

3.4. Target Population

The target population for this study consisted of all seventh graders and parents in all Public Primary schools in Itezhi-tezhi District.

3.5. Sample Size

A total sample size of 216 respondents was used in this study. This consisted 108 seventh graders and 108 parents who rated their children's executive function skills based on Behavioural Rating Inventory for Executive Functions second edition (BRIEF2). This implied that the selection of 108 seventh graders automatically selected their parents into the study as well. In terms of gender, there were 54 boys and 54 girls. For parents, there were 80 females and 28 males. In terms of home literacy, 85 respondents were coming from homes which are not exposed and 23 were coming from homes which were exposed to literacy. Further, when their socioeconomic status was interrogated, none of the respondents were from high socioeconomic status homes while 24 were from middle socioeconomic status and 84 were from low socioeconomic status homes. In terms of primary language used by respondents, Tonga was the outspoken language (37), followed by Illa (36), Chinyanja (16) and other languages (15).

3.6. Sampling Techniques

3.6.1 Stratified sampling technique

Stratified sampling technique was used to select 108 pupils from the sampled primary schools in Itezhi-tezhi District. Stratified sampling technique was used since pupils were selected based on their gender to participate in the study. All the names of pupils from classes were written on small pieces of paper and then folded to hide student names. The folded pieces of paper were put into a small container and thoroughly mixed. One piece of paper was picked from the

container and the name of the pupil was recorded. The Same procedure was applied to select all the 108 pupils in the sampled primary schools.

3.6.2 Simple random sampling technique

The study used simple random sampling drawn from probability technique to select the six primary schools and respondents in Itezhi-tezhi District. All the names of primary schools were written on small pieces of paper and then folded to hide school names. The folded pieces of paper were put into a small container and thoroughly mixed. One piece of paper was picked from the container and the name of the school was recorded. Same procedure was applied until all the six primary schools were obtained. Similar procedure was applied to select the remaining number of schools in the District.

3.7. Research Instruments

The study used the following tools to assess EF: Delis-Kaplan Executive function system (D. KEFS), Pencil Taping Test (opposite taping), Behavioural Rating Inventory for Executive Functions second edition (BRIEF2), and Digit Span Test (Forward, Backward and Sequencing). These tools been used by various scholars in Zambia and have shown consistence in results (Kabuba et al, 2018; Kalumba, 2017; Mwanza-Kabaghe, 2015; Mwanza-Kabaghe et al, 2015). Other instruments used in the study include, Reading Comprehension Assessment Tool (RCAT) which measured reading comprehension while Kaufman's Pattern Reasoning Test (PRT), Biographic Data Form (BDF), Home Literacy Environment Questionnaire (HLEQ) and School Literacy Environment Questionnaire (SLEQ) were used to measure the influence of background variables in the study.

3.7.1. Pencil Taping Test (Opposite Taping)

The pencil taping test (opposite taping) was used to measure working memory and inhibitory control. The assessor and the child held a pencil and the child was instructed that when the assessor taped his pencil once, the child had to tap his/hers twice and vice-versa. Further, when the assessor taped his pencil three times, the child was told not tap his or her pencil at all thereby, inhibiting his or her response to emulate the assessor's behaviour. After a series of trials of tapping in which the Child showed the ability to do three sequences in a row correctly, then the child was certified knowledgeable and 40 pencil test taps were administered and the assessor recorded the outcome.

3.7.2. Behavioural Rating Inventory for Executive Functions (BRIEF2)

Behavioural Rating Inventory for Executive Functions second edition (BRIEF2) was used as a subjective measure of executive function skills to get information about everyday behaviour associated with specific domains of executive function of seventh graders in the study. The researcher administered BRIEF2 to parent or guardians and they filled them in the presence of researcher so that they can be guided where clarity was needed. BRIEF2 has 63 statements in line with specific domains of executive functions and parents or guardian were required to show whether their children had problems described by the 63 statement over the past six months. Parents or guardian were required to circle letters against each statement as follows: **N**, if the behaviour is Never a problem, **S**, if the behaviour is sometimes a problem and **O**, if the behaviour is often a problem. It took approximately about 25 minutes to complete the form.

3.7.3. Delis-Kaplan Executive Function System-Trail Making Test (D. KEFS)

Delis-Kaplan Executive function system (D. KEFS) is a non-verbal executive function test which assesses working memory, inhibitory control, cognitive flexibility, motor speed and attention as measures of executive function skills appropriate for use in children. The test had conditions ranging from 1-5. Condition 1 required a child to cancel threes only from a combination of other numbers and letters within 150 seconds, condition 2; required a child to sequence numbers only and condition 3; to sequence letters only within 150 seconds, in condition 4; a child was required to switch between numbers and letters within 240 seconds and condition 5; was for motor speed which required a child to trace a line between given points within 150 seconds.

3.7.4. Digit Span Test (Forward, Backward and Sequencing)

Digit Span Test (DST) is a test for remembering which assesses working memory and cognitive flexibility. Children listened to the assessor and repeated numbers which were read according to Forward, Backward or Sequencing instructions. In forward Digit Span Test, the assessor was shouting digits and the respondents were required to recite them exactly the way the assessor mentioned the digits, for instance, if the assessor mentioned 5, 4, 1, 7 the respondent should say exactly 5, 4, 1, 7 as well. In Backward Digit Span Test, the assessor was shouting digits and the respondents were required to recite them in the opposite way or backward, for instance, if the assessor mentioned 9, 3, 8, 6, the respondent should say 6, 8, 3, 9. In sequencing Digit Span Test, the assessor was shouting digits and the respondent were required to recite them by ranking the digits starting with smallest number and ending with the biggest number, for

instance, if the assessor mentioned 7, 5, 8, 1, the respondent ranked the numbers in ascending order and responded as follows 1, 5, 7, 8, responses by respondents were recorded by the assessor.

3.7.5. Reading comprehension Assessment Tool (RCAT)

Reading comprehension was measured using Reading Comprehension Assessment Tool (RCAT) adapted from grade seven text book. The assessment tool had three comprehension passages with five questions from each passage. The three reading comprehension passages were used for triangulation purposes so that judgement of performance of respondents was based on their performance on all the three passages. The researcher administered the assessment and children were required to complete it within a standardised time of 60 minutes. The reading comprehension assessment tool was piloted to ensure that it was measuring what it was intended to measure.

3.7.6. Pattern Reasoning Test (PRT)

Pattern Reasoning Test was used to measure indicators of general intelligence. As a measure of non-verbal cognitive skills, a set of items were shown to children with series of stimuli forming a logical linear pattern with one stimulus missing. The child was asked to choose the missing stimulus from four to six options at the bottom of the page. This was used purely as a background factor control measure as it is known that intelligence influences reading hence it had to be controlled.

3.7.7. Biographic Data Form (BDF)

Biographic Data Form (BDF) was administered to parent of grade seven pupils who were selected in the study. The instrument was used to generate biographical information of each child such as personal details name, age and sex and Home Possession Index (HPI). The BDF instrument had 14 items on Home Possession Index (HPI) intended to compile information which was used to establish the socio-economic status of homes where the pupils selected in the study were coming from. This was necessary because Social Economic Status (SES) is known to influence reading (Mwanza-Kabaghe, 2015; Chansa-Kabali, 2014; Matafwali, 2011) and therefore needed to be controlled for in the study.

3.7.8. Home Literacy Environment Questionnaire (HLEQ)

Parents/Guardians were required to fill in the Home Literacy Environment Questionnaire to get information about literacy levels of home where the selected seventh graders were coming

from. The Home Literacy Environment Questionnaire addressed two aspects, namely: the home literacy and the home learning-support. The information obtained on the Home Literacy Environment Questionnaire helped to give an insight on Home-Literacy and Learning Support available where the children stayed. It took approximately about 30 minutes to complete filling the questionnaire. This was also important as a factor to consider as Home Literacy Environment (HLE) is known to influence reading (Mubanga, 2015)

3.7.9. School Literacy Environment Checklist (SLEC)

The researcher administered School Literacy Environment Checklist (SLEC) to get information about availability and accessibility of school reading materials. The information obtained on the School Literacy Environment Checklist helped to give an insight on School Literacy and Learning Support available in schools where the children were learning from. It took approximately about 20 minutes to complete the School Literacy Environment Checklist.

3.8. Validity and Reliability

Validation of research instruments refers to process of examining whether or not the instruments have the capacity to gather the anticipated data or not. Validity is a degree to which an instrument can provide accurate data as required by the research (Msabila and Nalaila, 2013). Reliability on the other hand refers to how consistent a measuring device is (Achola and Bless, 2000). In the quest to ensure validity of the instruments used to collect data on the influence of executive functioning on reading comprehension among grade seven pupils in Itezhi-tezhi District, the researcher performed Cronbach alpha reliability test on the instruments used in the study and the value of alpha was between 0.8 to 1.00 implying that instruments had good to excellent internal consistency. Further, the researcher subjected the instruments to a pilot study in two public primary schools which were not to be part of the sampled schools in Itezhi-tezhi District. The piloting process gave the researcher an opportunity to confirm credibility of the instruments. In order to enhance reliability of the instruments in this study, data collected was verified using triangulation. Triangulation was done by using different instruments which objectively and subjectively measured executive function to see whether there was consistency in the results.

3.9. Data Collection Procedure

The researcher applied and got clearance from the University of Zambia Humanities and Social Sciences Research Ethical Committee (UNZA-HSSREC) before going in the field to collect

data. After getting clearance from ethical committee, an introductory letter was gotten from Postgraduate Assistant Dean in the school of education. The researcher further got permission from the District Education Board Secretary (DEBS) before proceeding to collect data from selected schools. At school level, permission was gotten from Head Teachers of respective schools to get permission to meet selected respondents. After getting permission from respective Head Teachers, the researcher selected respondents. The researcher got informed consent from parents and guardians of pupils who were selected in the study thereafter data collection through administering of assessments in controlled environment as required by the research design was done.

3.10. Data Analysis

This was a quantitative study implying that data analysis was done quantitatively using Stata version 14. All executive function raw task scores obtained using objective measures and parental ratings obtained through subjective measures were converted to t-scores (scaled scores) using a standardized manual. Descriptive statistics was used to analyse variables. Both Spearman and Pearson correlations were used to show relationship between objective and subjective measure of executive function skills and reading comprehension.

3.11. Ethical Considerations

The researcher made sure that participation by the pupils and parents was voluntary and no one was forced to take part in the study. An informed consent was sought from parents of the pupils who were selected in the study. Participants were informed that they were free to withdraw from the study at any time they so wished and that such an action attracted no consequences. The researcher explained to participants the procedure, relevance, purpose of the study and that the data to be collected would be kept confidential and meant for research purposes. The researcher assured that participants' names and personal details were not revealed or published. Names of schools and participants were given codes in order to maintain anonymity.

3.12. Summary of the Chapter

The chapter outlined the methodology which was employed in the study. The methodology included the following sections: philosophical paradigm and positivist in particular on which the study was anchored, a research design known as quasi-experimental which is non-interventional in nature, target population included all the seventh graders and parents in all public primary schools, a total sample size of 216 which was distributed equally into 108

pupils and 108 parents, stratified and simple random sampling techniques were utilised, among the research instruments used were KEFS, BRIEF, DST, RCAT, PRT BDF, HLEQ and PTT, data quality control was assured by [performing Cronbach alpha on all instruments and the value of alpha ranged between 0.8. and 1.00 which implied good to excellent internal consistency. Further, data collection procedure was done through obtaining of relevant documentation from the relevant authorities and data was analysed using Stata version 14 to run correlations between executive functioning variables and reading comprehension as an outcome variable. Ethical consideration was highly upheld in the study by obtaining informed consent and explaining issues of confidentiality as well as ensuring anonymity. The next chapter presents the research findings of the study based on research questions.

CHAPTER FOUR: PRESENTATION OF FINDINGS

4.1 Overview

The previous chapter gave an insight on the methodological approaches used in the study. This included philosophical assumption, research design, and population, sample and sampling techniques, research instruments, validity and reliability, data collection procedure, data analysis and ethical considerations. The current chapter presents research findings. It begins with details on demographic characteristics of participants and background variables to establish how they influenced the research findings depending on their contribution. The presentation of findings is arranged according to research questions as follows:

1. What are the executive function skills of seventh graders in six selected primary schools in Itezhi-tezhi District?
2. What are the reading comprehension levels among seventh graders in six selected primary schools in Itezhi-tezhi District?
3. What is the correlation between executive function and reading comprehension among seventh graders in six selected primary schools in Itezhi-tezhi District?

Table 4.2. Demographic characteristics of participants

VARIABLES	FREQUENCY (%)
Gender (Boys)	54 (50)
(Girls)	54 (50)
Age (mean) (S.D)	13 (1.3)
General intelligence (mean) (S.D)	11.3 (4.7)
Home literacy (Exposed Homes)	23 (21)
(Non-exposed Homes)	85 (79)
Participant's Reading comprehension Levels	
(Below average: 0-5 Marks)	45 (42)
(Average: 6-10 Marks)	47 (44)
(Above average: 11-15 Marks)	16 (15)
Socio-Economic Status (High ses)	0 (0)
(Middle ses)	24 (22)
(Low ses)	84 (78)
Residence (Staying within School)	22 (20)
(Staying outside School)	86 (80)
Primary Language (Tonga)	37 (34)
(Ila)	36 (33)
(Nyanja)	16 (15)
(English)	0 (0)
(Others)	15 (18)
School Reading materials (Available and accessible)	72 (67)
(Available but not accessible)	36 (33)

Table 4.2 indicates that there was equal number of boys 54 (50%) and girls 54 (50%) in the study and the average age of participants was 13 years. The average general intelligence of participants was 13 out of 19 marks. In terms of home literacy, 23 (21%) out 108 participants were coming from homes exposed to literacy while 87 (79%) out of 108 participants were coming from homes which are not exposed to literacy. On reading comprehension levels, 16 (15%) participants scored above average (11 to 15 marks) while 47 (44%) scored average (6 to 10 marks) and 45 (42%) scored below average (0 to 5 Marks). Further the table shows that none of participants out of 108 came from high socio-economic status 0 (0%), while 24 (22%) came from homes with middle socio-economic status and 84 (78%) came from homes with low socio-economic status. In terms of residential areas, 22 (20%) participants out 108 were residents within the school and 86 (80%) were residents outside school. The language mostly used by participants was Tonga 37 (34%), followed by Ila 36 (33%), the least was Chinyanja 16 (15%) and other languages 15 (18%). In terms of school reading materials, 72 (67%) participants were at schools where reading materials were available and accessible while 36 (33%) were at schools where reading materials were available but not accessible.

Table 4.2.1 Associations between demographic characteristics and Home Literacy

<i>Variables</i>	<i>Home Literacy</i>		<i>P-value</i>
	<i>Exposed home (%)</i>	<i>Non-exposed home (%)</i>	
Gender (Boys)	11 (20)	43 (80)	0.81
(Girls)	12 (22)	42 (78)	
Age (mean) (S.D)	13.3 (1.4)	13.7 (1.3)	0.23
General intelligence (mean) (S.D)	12.5 (4.4)	11.0 (4.7)	0.17
Socio-Economic Status (High ses)	0 (0)	0 (0)	<0.001
(Middle ses)	23 (96)	1 (4)	
(Low ses)	0 (0)	84 (100)	
Residence (Staying within School)	21 (95)	1 (5)	<0.001
(Staying outside School)	2 (2)	84 (98)	
Primary Language (Tonga)	11 (30)	26 (70)	0.29
(Ila)	5 (14)	31 (86)	
(Nyanja)	2 (13)	14 (88)	
(English)	0 (0)	0 (0)	
(Others)	5 (26)	14 (74)	
School Reading Materials (Available and accessible)	15 (21)	57 (79)	0.87
(Available but not accessible)	8 (22)	28 (78)	
School Code (All were Public Schools) A:	6 (33)	12 (67)	0.51
B:	1 (6)	17 (94)	
C:	4 (22)	14 (78)	
D:	4 (22)	14 (78)	
E:	4 (22)	14 (78)	
F:	4 (22)	14 (78)	

Table 4.2.2 Shows that there was statistically significant difference between exposed and non-exposed literacy homes based on socio-economic status ($p<0.001$) and residence ($p<0.001$) respectively. Further the table shows that there was no statistical significant difference on gender ($p=0.81$), mean age ($p=0.23$), general intelligence ($p=0.17$), Primary language ($p=0.29$), School reading materials ($p=0.87$) and school type ($p=0.51$).

It was cardinal to determine the relationship among background variables and reading comprehension in order to account for their effect size on reading comprehension as an outcome variable. In order to do this, hierarchical linear regression was performed as demonstrated in table 4.2.3 below;

Reading comprehension	Coef.	Std. Err.	t	P> t 	95% Conf. Interval	
SES	.216153	3.247024	-1.22	0.226	-10.39586	2.483553
Home literacy	.019267	3.283642	1.04	0.300	-3.093063	9.931597
School reading Materials	.0858661	.6644454	0.13	0.897	-1.231905	1.403637
General intelligence	.649118	.0688415	6.75	0.000	.3283808	.6014427
Cons	5.619494	3.922812	1.43	0.155	-2.160479	13.39947

From table 4.2.4 the results demonstrate that after holding home literacy, school reading materials and general intelligence constant, the effect size for SES on reading comprehension was $d = .216153$ ($p=0.23$), an indication that there was no statistical significant relationship between SES and reading comprehension. When SES, school reading materials and general intelligence were held constant, the effect size for home literacy on reading comprehension was $d = .019271$ ($p=0.30$) implying that there was no statistical significant relationship between home literacy and reading comprehension. When SES, Home literacy and general intelligence were held constant, the effect size for school reading materials on reading comprehension was $d = .085866$ ($p=0.89$) implying that there was no statistical significant relationship between school reading materials and reading comprehension. When SES, home literacy and school reading materials were held constant, the effect size for general intelligence was $d = .64911$

($p < 0.001$) implying a statistical significant relationship between general intelligence and reading comprehension.

4.3 Executive function skills of seventh graders in six selected primary schools in Itezhi-tezhi District?

In order to assess executive function skills among seventh graders, the following instruments which were objective and subjective in nature were administered. On the objective measure of executive function, the study used Delis-Kaplan Executive function system (D. KEFS), Digit span and Pencil Taping Test (Opposite Taping) while on the subjective measure of executive function, the study used Behavioural Rating Inventory for Executive Functions (BRIEF2).

The classification of executive function skills on objective measure was arrived at by considering the maximum and minimum scores of respondents on each variable. On objective measures of executive function skills, the higher the score the better the executive function and the lower the score the poorer the executive function skills scores with respect to age.

Table 4.3.5 Objective measure of executive function

<i>Variable</i>	<i>Instrument</i>	<i>Number (%) of Respondents with good executive function skills</i>	<i>Number (%) of Respondents with Poor executive function skills</i>	<i>Total number of Participants</i>
Inhibitory control and Working memory	D.KEFS (TMTC1)	23 (21)	85 (79)	108
Working memory	D.KEFS (TMTC2)	32 (30)	76 (70)	108
Working memory	D.KEFS (TMTC3)	38 (35)	70 (65)	108
Cognitive flexibility	D.KEFS (TMTC4)	22 (20)	86 (80)	108
Motor Speed	D.KEFS (TMTC5)	53 (49)	55 (51)	108
Working memory	Digit Span Forward	26 (24)	82 (76)	108
Inhibitory control	Digit Span Backward	35 (32)	73 (68)	108
Cognitive flexibility and Working memory	Digit Span Sequencing	24 (22)	84 (78)	108
Inhibitory control	<i>Pencil Taping (Opposite Taping)</i>	45 (42)	63 (58)	108

Table 4.3.5 shows that a greater number $n=75$ (69%) of seventh graders had poor executive function skills based on the objective measures of executive function. Only a smaller number $n=25$ (31 %) of seventh graders had good executive functions.

Further, the classification of executive function skills on subjective measure was arrived at by considering the maximum and minimum scores of respondents on each variable. On subjective measures of executive function skills, the lower the score the better the executive function skills and the higher the score the poorer the executive function with respect to age. This is because the instrument (BRIEF2) used as subjective measure of EF has negative statements describing the child's behaviour, therefore, a high score entails poor EF.

Table 4.3.6 Subjective measure of executive function

<i>Behavioural Rating Inventory for Executive Functions (BRIEF2)</i>			
<i>Variable</i>	<i>Number (%) of Respondents with good executive function skills (%)</i>	<i>Number (%) of Respondents with Poor executive function skills (%)</i>	<i>Total number of Participants</i>
Inhibit (Inhibitory control)	67 (62)	41 (38)	108
Self-monitor	86 (80)	22 (20)	108
Shift (Cognitive flexibility)	88 (81)	20 (19)	108
Emotional control	88 (81)	20 (19)	108
Initiate	78 (72)	30 (28)	108
Working memory	59 (55)	49 (45)	108
Plan and organise	77 (71)	31 (29)	108
Task monitor	71 (68)	37 (34)	108
Organisation of materials	88 (81)	20 (19)	108

Table 4.3.6. Shows parental ratings of seventh grader's executive function skills based on the Behavioural Rating Inventory for Executive Functions (BRIEF2). Based on the subjective measures of executive function, a greater number $n=78$ (72%) of seventh graders exhibited good executive function skills and a smaller number $n=30$ (28%) had poor executive functions.

4.4. Reading comprehension levels among seventh graders in six selected primary schools in Itezhi-tezhi District?

Reading comprehension was measured using Reading Comprehension Assessment Tool (RCAT) adapted from grade seven English test book. The assessment tool had three comprehension passages with five questions from each passage. This test was administered to all the children who participated in the study and were in grade seven (7) class. The total marks for this test was rated out of fifteen (15) and the performance scale is presented in table 4.4.7 below.

Table 4.4.7 Performance scale on Reading comprehension Assessment Tool (RCAT)

<i>Reading Comprehension</i>	<i>Performance Scale</i>			<i>Total number of Participants</i>
	<i>Above average (%)</i>	<i>Average (%)</i>	<i>Below Average (%)</i>	
	16 (15)	47 (44)	45 (42)	108
<i>Triad scores: 0-5 Marks= Below average, 6-10 Marks= Average, 11-15 Marks= Above average</i>				

Table 4.4.7 Shows that a greater number n=47 (44%) of seventh graders' reading comprehension performance was average followed by those that were below average n=45 (42%) and the least were above average n=16 (15%).

4.5. Correlation between executive function and reading comprehension among seventh graders in six primary schools in Itezhi-tezhi District?

In order to establish the relationship between executive function and reading comprehension among seventh graders, correlation was performed on both objective and subjective measures of executive function and reading comprehension as shown in the table below.

Table 4.5.8 Correlation between Reading comprehension and objective measures of executive function skills

	<i>Variables</i>	<i>Instrument</i>	<i>Correlation Co-efficient</i>	<i>P-Value</i>
READING COMPREHENSION	<i>Inhibitory control and Working memory</i>	D.KEFS (Condition1)	-0.78	<0.001
	Working memory	D.KEFS (TMTC2)	-0.82	<0.001
	Working memory	D.KEFS (TMTC3)	-0.83	<0.001
	Cognitive flexibility	D.KEFS (TMTC4)	-0.86	<0.001
	Motor Speed	D.KEFS (TMTC5)	-0.70	<0.001
	Working memory	Digit Span Forward	0.82	<0.001
	Inhibitory control	Digit Span Backward	0.76	<0.001
	Cognitive flexibility and Working memory	Digit Span Sequencing	0.78	<0.001
	Inhibitory control	<i>Pencil Taping Test (Opposite Taping)</i>	0.77	<0.001

Table 4.5.8. Indicates that there is statistically significant relationship between reading comprehension and the core executive function skills ($p < 0.001$). This means that children who performed well on reading equally had good executive functioning skills.

Table 4.5.9 Correlation between Reading comprehension and subjective measures of executive function skills

Behavioural Rating Inventory for Executive Functions (BRIEF2)

	<i>Variables</i>	<i>Correlation Co-efficient</i>	<i>P-Value</i>
READING COMPREHENSION	Inhibit (Inhibitory control)	-0.21	0.03
	Self-monitor	-0.06	0.54
	Shift (Cognitive flexibility)	-0.22	0.02
	Emotional control	-0.03	0.72
	Initiate	-0.18	0.07
	Working memory	-0.22	0.02
	Plan and organise	-0.18	0.06
	Task monitor	-0.19	0.05
	Organisation of materials	-0.25	0.01

Table 4.5.9. Shows that there is a statistically significant relationship between reading comprehension and the core skill of executive function skills, Inhibitory control ($r = -0.21$, $p = 0.03$), Shift ($r = -0.22$, $p = 0.02$), Working memory ($r = -0.22$, $p = 0.02$). However, two other sub domains under subjective measures of executive function had a statistical significant relationship with reading comprehension, (Task monitor ($r = -0.19$, $p = 0.05$) and Organisation of materials ($r = -0.25$, $p = 0.01$). A difference was noted with Self-monitor ($r = -0.06$, $p = 0.54$), Emotional control ($r = -0.03$, $p = 0.72$), Initiate ($r = -0.18$, $p = 0.07$), Plan and organise ($r = -0.18$, $p = 0.06$) which indicated no statistically significant relationship with reading comprehension.

4.6. Summary of the Chapter

The chapter was presented in tandem with research findings. It begun with details on demographic characteristics of participants on background variables to establish how they influenced the research findings depending on their contribution. On assessing executive function, the study found that a greater number $n = 75$ (69%) of seventh graders had poor executive function skills when tested using objective measures of executive function. Only a minority $n = 25$ (31 %) had good executive functions. On the subjective measure of executive function skills using Behavioural Rating Inventory for Executive Functions (BRIEF2), the study found that a greater number $n = 78$ (72%) of seventh graders exhibited good executive function skills and only a minority $n = 30$ (28%) had poor executive functions. On reading comprehension, the study found that a greater number $n = 47$ (44%) of the seventh grader's performance was average. however, this was not the expected result as only 16 (15%) performed above average and 45 (42%) performed below average.

Further, on the relationship between executive function and reading comprehension among seventh graders, correlation was performed on both objective and subjective measures of executive function skills. The results on objective measures of executive function skills indicate that there is statistically significant relationship between reading comprehension and the core executive function skills ($p < 0.001$). On subjective measures of executive function, the study found a statistically significant relationship between reading comprehension and the core executive function skills. For instance, Inhibitory control ($r = -0.21$, $p = 0.03$), Cognitive flexibility ($r = -0.22$, $p = 0.02$), Working memory ($r = -0.22$, $p = 0.02$). However, two other sub domains under subjective measures of executive function had a statistical significant relationship with reading comprehension as well (Task monitor ($r = -0.19$, $p = 0.05$) and Organisation of materials ($r = -0.25$, $p = 0.01$). A difference was noted with Self-monitor ($r = -0.06$, $p = 0.54$), Emotional control ($r = -0.03$, $p = 0.72$), Initiate ($r = -0.18$, $p = 0.07$), Plan and

organise ($r = -0.18$, $p=0.06$) which indicated no statistically significant relationship with reading comprehension. The next chapter discusses the research findings according research objectives.

CHAPTER FIVE: DISCUSSION OF RESEARCH FINDINGS

5.1 Overview

The previous chapter gave an insight on the research findings. It begun with details on demographic characteristics of participants on background variables to establish how they influenced the research findings depending on their contribution. The presentation of findings was further arranged according to research questions. The current chapter discusses research findings according to research objectives as follows:

1. To assess executive function skills among seventh graders in six selected primary schools in Itezhi-tezhi District.
2. To measure reading comprehension levels among seventh graders in six selected primary schools in Itezhi-tezhi District.
3. To establish correlation between executive function and reading comprehension among seventh graders in six selected primary schools in Itezhi-tezhi District.

5.2. Effects of background variables on reading comprehension

On the relationship between the background variables and reading comprehension, the results of the study demonstrated that the effect size for SES was $d=.216153$ ($p=0.23$), home literacy was $d=.019271$ ($p=0.30$), school reading materials was $d=.085866$ ($p=0.89$) and general intelligence was $d=.64911$ ($p<0.001$). In this study, SES, home literacy and school reading materials had small effect size on reading comprehension implying that there was no statistical significant relationship between SES, home literacy school reading materials and reading comprehension. Therefore, it can be stated that SES, home literacy school reading materials had no effect on reading comprehension in the current study. This finding implies that among the background variables interrogated in the study, only general intelligence had moderate effect size and demonstrated a statistical significant relationship with reading comprehension. This is not surprising because general intelligence aids academic performance which was part of reading comprehension as the two variables (general intelligence and reading comprehension) are direct proportional to each other. Therefore, reading comprehension was not influenced by SES or home literacy and school reading materials but only general intelligence has a moderate effect. This implies that when structuring a reading activity in a school environment, there is need to control for extraneous variables that could alter the real effect size of reading comprehension as an outcome variable under interrogation in order to

have sound intervention that would promote reading skills among children in schools across the country.

5.3. Assessing executive function skills among seventh graders in six selected primary schools in Itezhi-tezhi District.

When executive function skills were assessed among seventh graders using objective measures of executive function, the findings indicated that a greater number $n=75$ (69%) of seventh graders had poor executive function skills. Only a minority $n=25$ (31 %) had good executive functions. This was evident as most of the seventh graders exhibited poor performance on most of executive function tasks which were measuring core skills of executive function (inhibitory control, working memory and cognitive flexibility). This finding is in agreement with previous studies (Barkley 2012; Cecile, Arief and Ludovica, 2017; Zelazo, Blair and Willoughby, 2017; Mwanza-Kabaghe, 2015; Keli, 2014; McClelland et al. 2007) who found that poor executive function skills made it difficult for people to plan, read, organize, remember things, prioritize, pay attention and get tasks started.

This entails that poor EF as found in this study is associated with poor reading ability because empirical evidence indicate that the core EF skills (Working memory, Inhibitory control and Cognitive flexibility) are necessary prerequisites for reading comprehension attainment, understanding words, sentences and texts. Children who have difficulties with reading comprehension, despite having age-appropriate word reading skills, have poor executive function than their peers with better comprehension. These empirical discoveries are important for all educators because reading comprehension is the foundation for all other learning in school. Learners cannot understand, enjoy, or respond to literature without effective reading comprehension, likewise, learners cannot gather new information from science, math, or other subject texts when they do not understand what they read. Here is a how these core EF skills affect reading comprehension, Working Memory is the capacity for holding information in mind while working with part of that information. When building text meaning, a good Comprehenders must keep in mind the various text ideas presented, note the causal links between them, and update the meaning as he/she encounters new ideas in text. This implies that poor working memory is synonymous to poor reading ability (Best, 2010).

Cognitive Flexibility is the ability to shift attention from one activity to another or to actively switch back and forth between important components of a task. When reading, skilled

Comprehenders actively shift focus between many things, such as word and text meanings, letter-sound information, and syntactic (sentence grammar) information. This as well implies that deficit in Cognitive flexibility results in poor reading ability. Inhibitory Control is the ability to resist engaging in a habitual response as well as the ability to ignore distracting information for instance, to think before acting. Good Comprehenders must inhibit activation of inappropriate word meanings or irrelevant connections to ideas encountered in texts to fully understand written passages (Baddeley, 1999). This implies that learners with poor inhibitory control may not be able to read with understanding. The general implication of the findings in this study is that concerted efforts from curriculum developers is needed to ensure that the school curriculum is tailored to promotion of stimulative activities that would enhance executive function skills at an early stage of development.

On the contrary, when subjective measures of executive function skills were assessed among seventh graders using Behavioural Rating Inventory for Executive Functions (BRIEF2), the finding of the study indicated that, a greater number $n=78$ (72%) of seventh graders exhibited good executive function skills and a smaller number $n=30$ (28%) had poor executive functions. This was so because the ratings were done by parents who might have overrated their children as reflected by the results of the objective measures. This implies that parental ratings were subjective therefore interpretation of the results should be done with caution for the purpose of reliability. In this study, in order to authenticate the subjectivity of Behavioural Rating Inventory for Executive Functions (BRIEF2), the study assessed executive function using both objective and subjective measures. This finding is in agreement with (Šimleša, Capanec, and Ljubešić, 2017; Chrysochoou, Bablekou, and Tsigilis, 2011; Mwanza-Kabaghe, 2015; Kalumba, 2017). However, there was inconstancy on emotional control where Mwanza-Kabaghe, (2015) Kalumba, (2017) found that children (first and second graders) were not able to control their emotions. This study found that all seventh graders $n=108$ (100%) who were selected in the study were able to control their emotions. This may be attributed to the age of seventh graders in that by the seventh grade, children have grown and are able to control their emotions.

5.4. Measuring reading comprehension levels among seventh graders in six selected primary schools in Itezhi-tezhi District.

Reading comprehension is one of the goal directed tasks which require engaging executive function, as such, it was imperative to exploit it in line with the demands of this study as it was

assessed using Reading Comprehension Assessment Tool (RCAT) adapted from grade seven English test book. Based on Reading Comprehension Assessment Tool (RCAT), the study found that a greater number $n=47$ (44%) of the seventh grader's performance was average. however, this was not the expected result as only 16 (15%) performed above average and 45 (42%) performed below average. This finding is inconsistent with other scholars such as (Matafwali, 2010; Mwambazi, 2011; Chansa-Kabali, 2014; Tambulukani, 2015; SACMEQ report, 2016; Kamalata, 2016; Chipili, 2016; Mulenga, 2017) who observed low reading levels among Zambian school going children. However, it is important to note that the difference between seventh graders whose performance was average and those whose performance was below average was just 2%. This indicate that the finding of this study on reading comprehension cannot be cerebrated because the difference is not statistically significant. Therefore, more concerted efforts from the relevant authorities must be realised in order to change the poor reading gap not only in schools but also in communities where pupils trace their background from for a betterment of the entire educational system and country at large.

It can be further stated that Working Memory influenced reading comprehension than inhibitory control and cognitive flexibility because all the 16 (15%) seventh graders who scored above average in reading comprehension performed well in all tasks measuring working memory. Therefore, the good performance by these 16 (15%) seventh graders in reading comprehension can be attributed to having good working memory. However, those who performed well in tasks measuring cognitive flexibility and inhibitory control only performed average in reading comprehension. This finding is in line with Baddeley (1996) and Gathercole, Alloway, Willis, and Adams (2006) who reported that working memory generally influenced reading than inhibitory control and cognitive flexibility. Working memory was conceived as a dynamic mechanism that involves the capacity to store information over short periods of time while engaging in other cognitively demanding activities. Tasks such as reading comprehension require complex mental processing such as working memory which require storage of the partial products of analysis during reading process. On the other hand, 45 (42%) of seventh graders who performed below average in reading comprehension all performed poorly on all tasks measuring working memory, cognitive flexibility and inhibitory control. This therefore, could be attributed to poor Working memory, cognitive flexibility and inhibitory control as reading inability is due to poor Executive function. This calls for concerted efforts especially from Ministry of General Education and other relevant stakeholders such as parents

in terms of policy direction to encourage and promote reading and writing skills to avoid the current situation of low literacy levels among school going children.

5.5 Correlation between executive function and reading comprehension among seventh graders in six selected primary schools in Itezhi-tezhi District.

To establish the relationship between executive function and reading comprehension among seventh graders, correlation was performed on both objective and subjective measures of executive function skills. The results on objective measures of executive function skills indicate that there is statistically significant relationship between reading comprehension and the core executive function skills ($p < 0.001$). This finding demonstrated a link between working memory, cognitive flexibility inhibitory control and reading comprehension. This is consistent with a growing body of literature demonstrating tight links between executive functioning and reading comprehension (Mwanza-Kabaghe, 2015; Wolf and McCoy, 2019; Kamza, 2017; Cartwright, et al, 2010; Butterfus and Kandeou, 2018; Cain, 2006; Best, 2010; Esopo, 2018; Willoughby et al, 2017; Jager and Condry, 2017; Osuji, 2017; Spaul and Pretorius, 2014, Vei, 2003) which investigated intensively the relationship between executive function and reading abilities among learners and reported a significant relationship between executive function reading abilities. EF and reading comprehension hold a strong relationship and has little to do with rote memorizing or learning facts. EF has more to do with reasoning, problem solving and using the knowledge acquired from rote memory to make inferences and solve problems. Reading comprehension is a highly demanding task that requires coordination of various EF domains. This entails that the core executive skills (working memory, inhibitory control and cognitive flexibility) were all important in influencing reading comprehension and therefore, the relevant authorities in the ministry of general education must desire to tailor the education activities in line with the demand of the three core skills of executive function.

Similarly, the finding of the study on correlation between objective measure of Executive function and reading comprehension is supported by Baddeley (1996)'s multi-component model (theory) which asserts that different executive function domains such as working memory, inhibitory control and cognitive flexibility contribute differently and simultaneously during cognitive processing. A capacity limitation or processing inefficiency in one or more of these executive function domains contribute to variability in reading performance. The theory also indicates that phonological loop (PL) and visuo spatial sketchpad (VSSP) are distinct brain regions involved during reading comprehension. The relationship between the three core

executive function skill and reading comprehension as demonstrated by findings of this study clearly prove the theoretical claims of Baddeley's theory. This entails that that Baddeley's multi component (model) theory is useful and should be utilised by scholars because it has demonstrated a link between executive function and reading comprehension among seventh graders in school.

This entails that executive function is an important component as it helps not only in influencing reading comprehension but also other goal directed tasks, therefore, this study is a step in the right direction as it has provided insightful information on reading which can be used in schools for decision making on the relationship between executive function and comprehension among the seventh graders. As school authorities endeavour to improve reading levels, special attention should be given to EF stimulation at an early age because it has been established that there is correlation between EF and reading comprehension. Policy makers should eradicate poor reading level using a holistic approach which targets both stimulation of executive function domains and improvement of other external factors known to be threats to reading abilities. This could be one clear solution needed in Zambia where reading levels are extremely poor.

5.6. Novel Knowledge

When subjective measures of executive function were correlated with reading comprehension, the study found a statistically significant relationship between reading comprehension and the three core executive function skills inhibitory control ($r = -0.21$, $p=0.03$), Cognitive Flexibility ($r = -0.22$, $p=0.02$), Working memory ($r = -0.22$, $p=0.02$) as well as two other sub domains of executive Task monitor ($r = -0.19$, $p=0.05$) and Organisation of materials ($r = -0.25$, $p=0.01$). However, a difference was noted with Self-monitor ($r = -0.06$, $p=0.54$), Emotional control ($r = -0.03$, $p=0.72$), Initiate ($r = -0.18$, $p=0.07$), Plan and organise ($r = -0.18$, $p=0.06$) which indicated no statistically significant relationship with reading comprehension. This finding of correlation between subjective measures of executive function Skills and reading comprehension is treated as novel knowledge specifically contributed by the current study as no clear documentation from the literature interrogated in the study have supported it.

Another novel knowledge contributed by the current study was the realisation on the classification of objective and subjective measures of Executive function. This was so because there is inadequate information from available literature regarding classification of

measurement of executive function as being objective and subjective, a component that the current study has endeavoured to add to the pool of knowledge.

5.7. Summary of the Chapter

The chapter gave an insight on discussion of research findings according to research objectives. On assessing executive function, the study found that a greater number $n=75$ (69%) of seventh graders had poor executive function skills when tested using objective measures of executive function. Only a minority $n=25$ (31 %) had good executive functions. On the subjective measure of executive function skills using Behavioural Rating Inventory for Executive Functions (BRIEF2), the study found that a greater number $n=78$ (72%) of seventh graders exhibited good executive function skills and only a minority $n= 30$ (28%) had poor executive functions. On reading comprehension, the study found that a greater number $n=47$ (44%) of the seventh grader's performance was average. however, this was not the expected result as only 16 (15%) performed above average and 45 (42%) performed below average.

Further, on the relationship between executive function and reading comprehension among seventh graders, correlation was performed on both objective and subjective measures of executive function skills. The results on objective measures of executive function skills indicate that there is statistically significant relationship between reading comprehension and the core executive function skills ($p<0.001$). On subjective measures of executive function, the study found a statistically significant relationship between reading comprehension and the core executive function skills. For instance, Inhibitory control ($r = -0.21$, $p=0.03$), Cognitive flexibility ($r = -0.22$, $p=0.02$), Working memory ($r = -0.22$, $p=0.02$). However, two other sub domains under subjective measures of executive function had a statistical significant relationship with reading comprehension as well (Task monitor ($r = -0.19$, $p=0.05$) and Organisation of materials ($r = -0.25$, $p=0.01$). A difference was noted with Self-monitor ($r = -0.06$, $p=0.54$), Emotional control ($r = -0.03$, $p=0.72$), Initiate ($r = -0.18$, $p=0.07$), Plan and organise ($r = -0.18$, $p=0.06$) which indicated no statistically significant relationship with reading comprehension. This finding of correlation between subjective measures of executive function Skills and reading comprehension is treated as novel knowledge specifically contributed by the current study as no clear documentation from the literature interrogated in the study have supported it. Another novel knowledge contributed by the current study was the realisation on the classification of objective and subjective measures of Executive function. This was so because there is inadequate information from available literature regarding classification of

measurement of executive function as being objective and subjective, a component that the current study has endeavoured to add to the pool of knowledge. The next chapter discusses the research findings according research objectives. The next chapter presents the study's conclusion and recommendations.

CHAPTER SIX: CONCLUSION AND RECOMMENDATIONS

6.1 Overview

The previous chapter gave an insight on discussion of research findings. The chapter discussed research findings according to research objectives as follows: to assess executive function skills among seventh graders in six selected primary schools in Itezhi-tezhi District, to measure reading comprehension levels among seventh graders in six selected primary schools in Itezhi-tezhi District and to examine the extent to which executive function influences reading comprehension among seventh graders in six selected primary schools in Itezhi-tezhi District. The current chapter presents conclusion and recommendations based on the findings of the study.

6.2. Conclusion

This study assessed the influence of executive functioning on reading comprehension among grade seven Pupils in Selected Primary Schools in Itezhi-tezhi District. Executive function is one among the subdomains of cognitive functioning consists of several brain-based skills that help people to organize, act on information, initiate, perform tasks, plan, organize, remember things, prioritize, pay attention and get tasks started and completed. As such, when executive function skills were assessed among seventh graders using objective measures, the findings indicated that a greater number $n=75$ (69%) of seventh graders had poor executive function skills. Only a minority $n=25$ (31 %) had good executive functions. This was evident as most of the seventh graders exhibited poor performance on most of executive function tasks which were measuring three core skills of executive function.

When subjective measures of executive function skills were assessed among seventh graders using Behavioural Rating Inventory for Executive Functions (BRIEF2), the findings of the study indicated that a greater number $n=78$ (72%) of seventh graders exhibited good executive function skills and a smaller number $n=30$ (28%) had poor executive functions. This was so because the ratings were done by parents who might have overrated their children's executive function skills as reflected by the results of the subjective measures of executive function skills. This implies that parental ratings were subjective therefore interpretation of the results was done with caution for purpose of reliability and to avoid bias.

Reading comprehension as one of the goal directed tasks which require engaging executive function was exploited using Reading Comprehension Assessment Tool (RCAT) and the

general finding indicated that a greater number $n=47$ (44%) of the seventh grader's performance was average. however, this was not the expected result as only 16 (15%) performed above average and 45 (42%) performed below average an indication that a lot more has to be done in the Zambian policy direction to encourage and promote reading and writing skills to avoid the current situation of low literacy levels among school going children.

Establishing the relationship between EF skills and reading comprehension among seventh graders was another component which was very cardinal in this study. Therefore, to establish the relationship between EF and reading comprehension among seventh graders, correlation was executed on both objective and subjective measures of executive function. Objective measures of executive function skills indicated a statistically significant relationship between reading comprehension and the three core executive function skills ($p<0.001$). This entails that EF is an important component as it helps not only in predicting reading comprehension but also other goal directed tasks, therefore, this study is a step in the right direction as it has provided insightful information to be used in schools for decision making on the relationship between executive function and reading comprehension among the seventh graders.

When subjective measures of EF were correlated with reading comprehension, the study found a statistically significant relationship between reading comprehension and the three core executive function skills inhibitory control ($r = -0.21$, $p=0.03$), Cognitive Flexibility ($r = -0.22$, $p=0.02$), Working memory ($r = -0.22$, $p=0.02$) as well as two other sub domains of executive Task monitor ($r = -0.19$, $p=0.05$) and Organisation of materials ($r = -0.25$, $p=0.01$). However, a difference was noted with Self-monitor ($r = -0.06$, $p=0.54$), Emotional control ($r = -0.03$, $p=0.72$), Initiate ($r = -0.18$, $p=0.07$), Plan and organise ($r = -0.18$, $p=0.06$) which indicated no statistically significant relationship with reading comprehension. This finding of correlation between subjective measures of EF Skills and reading comprehension is novel knowledge that has been contributed by the current study as no clear information from the literature interrogated in the study have supported it.

Another novel knowledge contributed by the current study was the realisation on the classification of both objective and subjective measures of EF. This was so because there is inadequate information from available literature regarding classification of measurement of EF as being objective and subjective in nature, a component that the current study has endeavoured to add to the pool of knowledge.

6.3. Recommendations

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

1. Curriculum Development Centre (CDC) should make Primary school curriculum responsive enough to accommodate and promote early stimulation of executive function skills among primary school children.
2. Schools should adopt and prepare lessons tailored to measure the constructs of executive function skills.
3. There is need for schools to create reading material banks within classrooms for easy accessibility in order to promote and enhance reading culture among primary school children.

6.4. Implications for future research

1. There is need for another study to be conducted in an urban set up since this study was conducted among schools in a rural area.
2. There is also need for a similar study to be conducted at junior secondary school level to verify claims made by scholars who advances that executive function develops from early childhood to adolescence.

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APPENDICES

Appendix 1: Approval of Study



THE UNIVERSITY OF ZAMBIA

DIRECTORATE OF RESEARCH AND GRADUATE STUDIES

Great East Road | P.O. Box 32379 | Lusaka 10101 | Tel: +260-211-290 258/291 777
Fax: +260-1-290 258/253 952 | Email: director@drgrs.unza.zm | Website: www.unza.zm

APPROVAL OF STUDY

28th January, 2020.

REF NO.HSSREC-2019-DEC-008

Mr Namushi Namakando
ITEZHI-TEZHI

Dear Namakando

RE: "THE INFLUENCE OF EXECUTIVE FUNCTIONING ON READING COMPREHENSION AMONG GRADE SEVEN PUPILS IN SELECTED PRIMARY SCHOOLS IN ITEZHI-TEZHI DISTRICT, ZAMBIA"

Reference is made to your protocol dated 6th December, 2019. HSSREC resolved to approve this study and your participation as Principal Investigator for a period of one year.

Review Type	Ordinary Review	Approval No. HSSREC-2019-DEC-008
Approval and Expiry Date	Approval Date: 28 th January, 2020	Expiry Date: 27 th January, 2021
Protocol Version and Date	Version - Nil.	27 th January, 2021
Information Sheet, Consent Forms and Dates	• English.	To be provided
Consent form ID and Date	Version - Nil	To be provided
Recruitment Materials	Nil	Nil
Other Study Documents	Questionnaire.	27 th January, 2021
Number of Participants Approved for Study		27 th January, 2021

Specific conditions 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

- 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 HSSREC within 5 days.
- All protocol modifications must be approved by HSSREC 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.
- All protocol deviations must be reported to HSSREC within 5 working days.
- All recruitment materials must be approved by HSSREC prior to being used.
- Principal investigators are responsible for initiating Continuing Review proceedings. HSSREC will only approve a study for a period of 12 months.
- It is the responsibility of the PI to renew his/her ethics approval through a renewal application to HSSREC.
- Where the PI desires to extend the study after expiry of the study period, documents for study extension must be received by HSSREC at least 30 days before the expiry date. This is for the purpose of facilitating the review process. Documents received within 30 days after expiry will be labelled “late submissions” and will incur a penalty fee of K500.00. No study shall be renewed whose documents are submitted for renewal 30 days after expiry of the certificate.
- Every 6 (six) months a progress report form supplied by The University of Zambia Humanities and Social Sciences Research Ethics Committee as an IRB must be filled in and submitted to us. There is a penalty of K500.00 for failure to submit the report.
- When closing a project, the PI is responsible for notifying, in writing or using the Research Ethics and Management Online (REMO), both HSSREC and the National Health Research Authority (NHRA) when ethics certification is no longer required for a project.
- In order to close an approved study, a Closing Report must be submitted in writing or through the REMO system. A Closing Report should be filed when data collection has ended and the study team will no longer be using human participants or animals or secondary data or have any direct or indirect contact with the research participants or animals for the study.
- Filing a closing report (rather than just letting your approval lapse) is important as it assists HSSREC in efficiently tracking and reporting on projects. Note that some


funding agencies and sponsors require a notice of closure from the IRB which had approved the study and can only be generated after the Closing Report has been filed.

- A reprint of this letter shall be done at a fee.
- All protocol modifications must be approved by HSSREC by way of 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. In all cases, except where noted above regarding subject safety, any changes to any protocol document or procedure must first be approved by HSSREC before they can be implemented.

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 HSSREC, we would like to wish you all the success as you carry out your study.

Yours faithfully,


Dr. J. L. I. Ziwa

**VICE CHAIRPERSON
THE UNIVERSITY OF ZAMBIA HUMANITIES AND
SOCIAL SCIENCES RESEARCH ETHICS COMMITTEE - IRB**

cc: Director, Directorate of Research and Graduate Studies
Assistant Director (Research), Directorate of Research and Graduate Studies
Assistant Registrar (Research), Directorate of Research and Graduate Studies

Appendix 2: Pencil Tapping Test

Subject ID:

Date:

Pencil Tapping Test

Give one pencil to the child, and keep one pencil for yourself

Say, "We are going to play a new game now. When I tap my pencil on the table once (demonstrate), I want you to tap your pencil twice. Can you do that?"

Allow child to practice until they tap correctly.

"When I tap my pencil twice, I want you to tap your pencil once. Can you do that?"

Allow child to practice until they tap correctly.

"When I tap my pencil three times, don't tap your pencil at all. Now let's try it."

Tap once, then twice, then three times, then repeat. Allow the child to practice until they are able to do three sequences in a row correctly.

"Great, now we are ready to play the game. When I tap one time, I want you to tap two times. When I tap two times, I want you to tap one time. When I tap three times, don't tap at all. Are you ready?" If child expresses that they are ready, begin.

Examiner Taps	Incorrect?		Incorrect?
1		1	
2		2	
2		1	
2		2	
1		3	
1		1	
1		1	
3		2	
2		2	
1		1	
2		3	
3		1	
1		1	
1		1	
2		3	
1		2	
2		1	
2		1	
2		1	
1		3	
Total Errors=		Total Score (40-total errors):	

Appendix 3: Behaviour Rating Inventory of Executive Function (BRIEF 2)

BRIEF[®] 2

Behavior Rating Inventory of Executive Function[®], Second Edition

PARENT FORM

Gerard A. Gioia, PhD, Peter K. Isquith, PhD,
Steven C. Guy, PhD, and Lauren Kenworthy, PhD

Instructions

On the following pages is a list of statements that describe children. We would like to know if your child has had problems with these behaviors over the past 6 months. Please answer all the items the best that you can. Please **DO NOT SKIP ANY ITEMS**. Think about your child as you read each statement and circle:

- N** if the behavior is **Never** a problem
- S** if the behavior is **Sometimes** a problem
- O** if the behavior is **Often** a problem

For example, if your child **never** has trouble completing homework on time, you would circle **N** for this item:

Has trouble completing homework on time ☒ N S O

If you make a mistake or want to change your answer, **DO NOT ERASE**. Draw an "X" through the answer you want to change and then circle the correct answer:

Has trouble completing homework on time ☒ N ☒ S O

Before you begin answering the items, please fill in your child's name, gender, age, grade, your relationship to the child, today's date, and child's date of birth in the spaces provided at the top of the next page.

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BRIEF-2 PARENT FORM

Date of birth _____

Child's name _____ Gender _____ Age _____ Grade _____

Rater's name _____ Relationship to child _____ Today's date _____

	Inhibit	Self-Monitor	Shift	Emotional Control	Initiate	Working Memory	Plan/Organize	Task-Monitor	Organization of Materials	1	2	3	
1.										1	2	3	
2.										1	2	3	
3.										1	2	3	
4.										1	2	3	I
5.										1	2	3	
6.										1	2	3	
7.										1	2	3	
8.										1	2	3	
9.										1	2	3	I
10.										1	2	3	I
11.										1	2	3	
12.										1	2	3	
13.										1	2	3	
14.										1	2	3	N
15.										1	2	3	
16.										1	2	3	
17.										1	2	3	I
18.										1	2	3	F
19.										1	2	3	
20.										1	2	3	I
21.										1	2	3	I
22.										1	2	3	I
23.										1	2	3	
24.										1	2	3	
25.										1	2	3	I
26.										1	2	3	I
27.										1	2	3	
28.										1	2	3	N
29.										1	2	3	
30.										1	2	3	N
31.										1	2	3	
32.										1	2	3	
										Subtotals (Items 1-32)			
	Inhibit	Self-Monitor	Shift	Emotional Control	Initiate	Working Memory	Plan/Organize	Task-Monitor	Organization of Materials				

	Inhibit	Self-Monitor	Shift	Emotional Control	Initiate	Working Memory	Plan/Organize	Task-Monitor	Organization of Materials			
33.										1	2	3
34.										1	2	3 N
35.										1	2	3
36.										1	2	3 F
37.										1	2	3 I
38.										1	2	3
39.										1	2	3 N
40.										1	2	3 I
41.										1	2	3 N
42.										1	2	3
43.										1	2	3
44.										1	2	3
45.										1	2	3
46.										1	2	3
47.										1	2	3
48.										1	2	3 I
49.										1	2	3
50.										1	2	3 I
51.										1	2	3
52.										1	2	3
53.										1	2	3
54.										1	2	3 F
55.										1	2	3 I
56.										1	2	3 I
57.										1	2	3
58.										1	2	3 N
59.										1	2	3
60.										1	2	3 N
61.										1	2	3
62.										1	2	3
63.										1	2	3 I

									Subtotals (Items 33-63)
									Subtotals (Items 1-32)
									Total raw scale scores
	Inhibit	Self-Monitor	Shift	Emotional Control	Initiate	Working Memory	Plan/Organize	Task-Monitor	Organization of Materials

BRIEF² PARENT FORM

Date of birth _____

Child's name _____ Gender _____ Age _____ Grade _____

Rater's name _____ Relationship to child _____ Today's date _____

	N = Never	S = Sometimes	O = Often
1. Is fidgety	N	S	O
2. Resists or has trouble accepting a different way to solve a problem with schoolwork, friends, tasks, etc.	N	S	O
3. When given three things to do, remembers only the first or last	N	S	O
4. Is unaware of how his/her behavior affects or bothers others	N	S	O
5. Work is sloppy	N	S	O
6. Has explosive, angry outbursts	N	S	O
7. Does not plan ahead for school assignments	N	S	O
8. Cannot find things in room or school desk	N	S	O
9. Is not a self-starter	N	S	O
10. Does not think before doing (is impulsive)	N	S	O
11. Has trouble getting used to new situations (classes, groups, friends, etc.)	N	S	O
12. Has a short attention span	N	S	O
13. Has poor understanding of own strengths and weaknesses	N	S	O
14. Has outbursts for little reason	N	S	O
15. Gets caught up in details and misses the big picture	N	S	O
16. Gets out of control more than friends	N	S	O
17. Gets stuck on one topic or activity	N	S	O
18. Forgets his/her name	N	S	O
19. Has trouble with chores or tasks that have more than one step	N	S	O
20. Does not realize that certain actions bother others	N	S	O
21. Written work is poorly organized	N	S	O
22. Small events trigger big reactions	N	S	O
23. Has good ideas but does not get job done (lacks follow-through)	N	S	O
24. Talks at the wrong time	N	S	O
25. Has trouble finishing tasks (chores, homework, etc.)	N	S	O
26. Does not notice when his/her behavior causes negative reactions	N	S	O
27. Reacts more strongly to situations than other children	N	S	O
28. Has trouble remembering things, even for a few minutes	N	S	O
29. Makes careless errors	N	S	O
30. Gets out of seat at the wrong times	N	S	O
31. Becomes upset with new situations	N	S	O
32. Has trouble concentrating on tasks, schoolwork, etc.	N	S	O

	N = Never	S = Sometimes	O = Often
33. Has poor handwriting	N	S	O
34. Mood changes frequently	N	S	O
35. Has good ideas but cannot get them on paper	N	S	O
36. Has trouble counting to three	N	S	O
37. Leaves messes that others have to clean up	N	S	O
38. Needs to be told to begin a task even when willing	N	S	O
39. Acts too wild or "out of control"	N	S	O
40. Thinks too much about the same topic	N	S	O
41. Forgets what he/she was doing	N	S	O
42. Does not check work for mistakes	N	S	O
43. Angry or tearful outbursts are intense but end suddenly	N	S	O
44. Becomes overwhelmed by large assignments	N	S	O
45. Loses lunch box, lunch money, permission slips, homework, etc.	N	S	O
46. Needs help from an adult to stay on task	N	S	O
47. Forgets to hand in homework, even when completed	N	S	O
48. Has trouble putting the brakes on his/her actions	N	S	O
49. Resists change of routine, foods, places, etc.	N	S	O
50. Has trouble getting started on homework or tasks	N	S	O
51. Mood is easily influenced by the situation	N	S	O
52. Underestimates time needed to finish tasks	N	S	O
53. Does not bring home homework, assignment sheets, materials, etc.	N	S	O
54. Cannot find the front door of home	N	S	O
55. Does not take initiative	N	S	O
56. Becomes upset too easily	N	S	O
57. Starts assignments or tasks at the last minute	N	S	O
58. Has trouble moving from one activity to another	N	S	O
59. Has trouble carrying out the actions needed to reach goals (saving money for special item, studying to get a good grade, etc.)	N	S	O
60. Is disturbed by change of teacher or class	N	S	O
61. Has trouble organizing activities with friends	N	S	O
62. Becomes too silly	N	S	O
63. Leaves a trail of belongings wherever he/she goes	N	S	O

Appendix 4: Delis. Kaplan Executive Function System-Trail Making Test (D. KEFS-TMT; Condition 1-5)

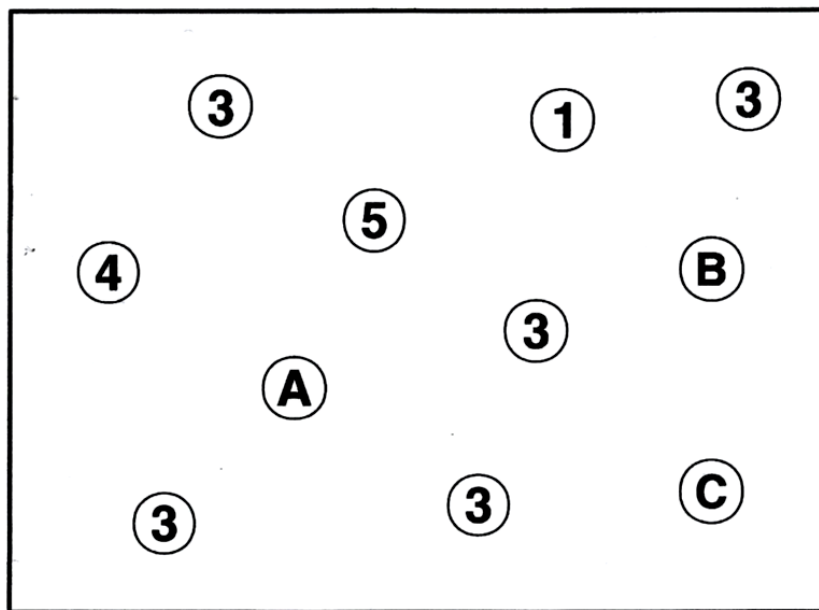


Name _____ Age _____
 ID _____ Date _____
 Examiner _____
 Notes _____

Trail Making Test

**Condition 1
Visual Scanning**

Practice

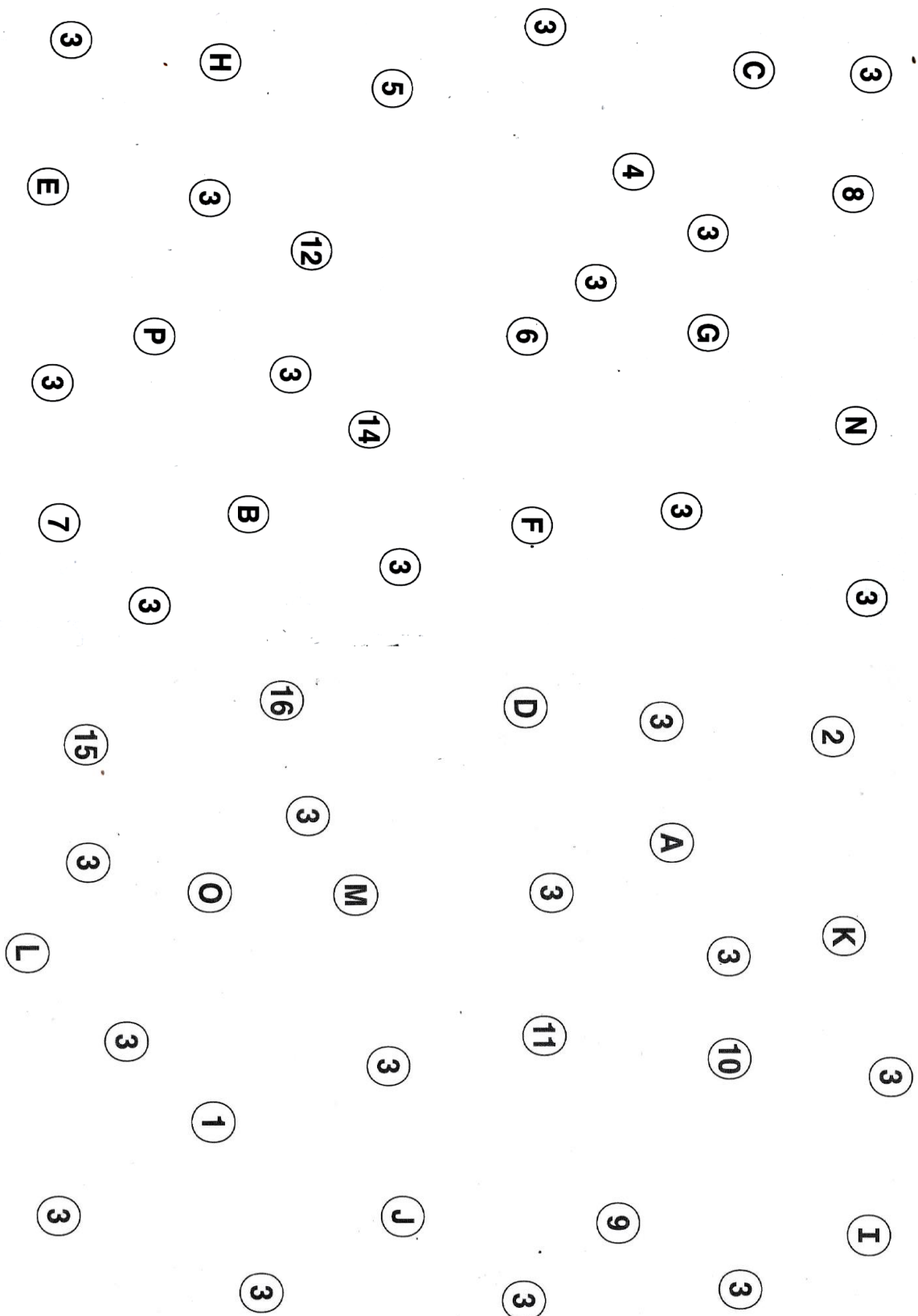


35 36 37 38 39 40 A B C D E

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Name _____ Age _____

ID _____ Date _____

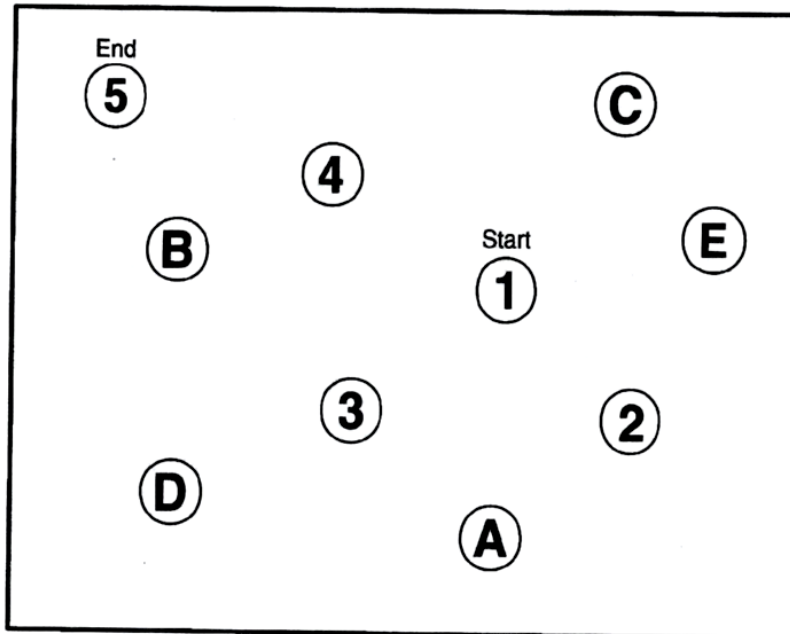
Examiner _____

Notes _____

Trail Making Test

Condition 2
Number Sequencing

Practice

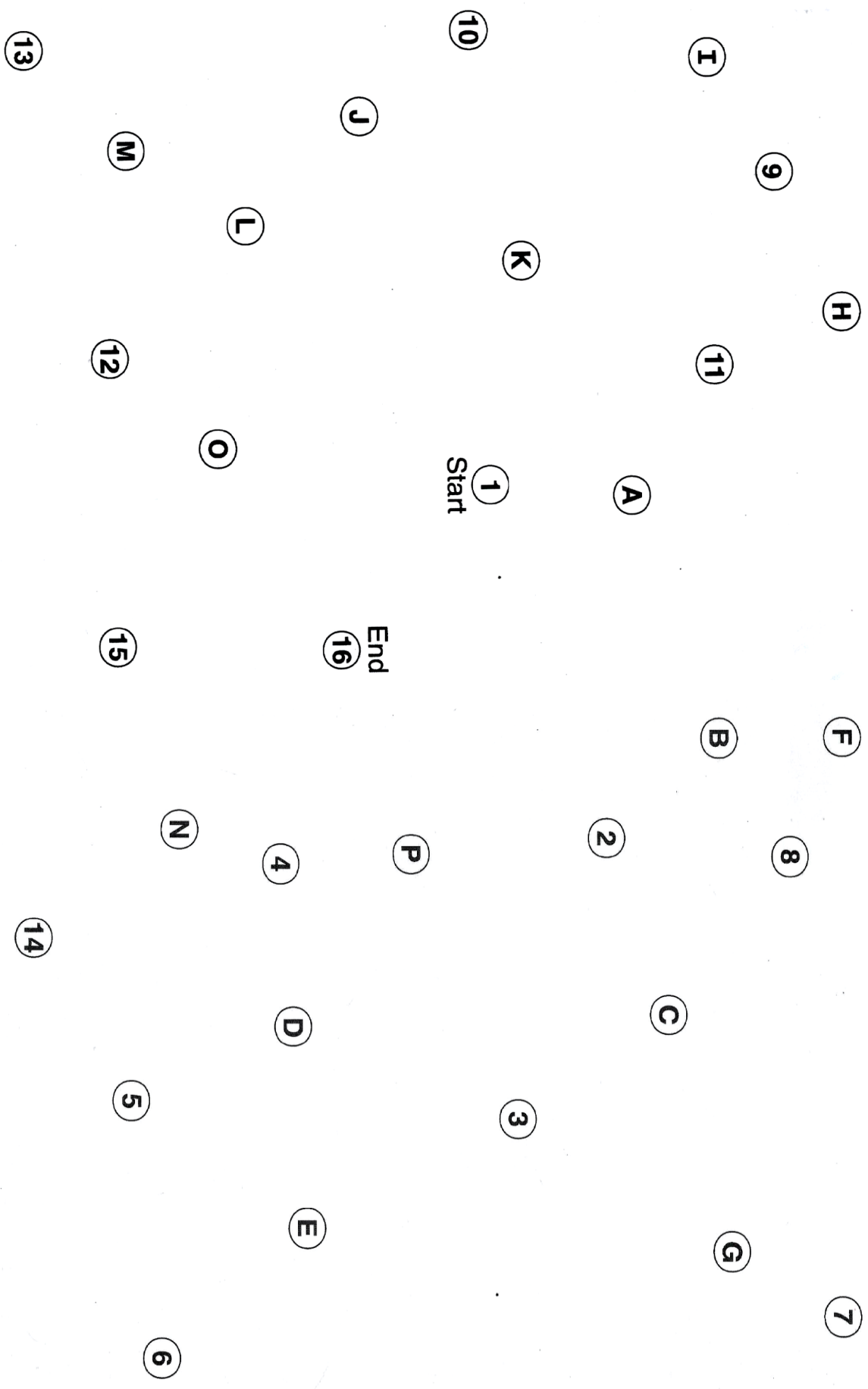


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Name _____ Age _____

ID _____ Date _____

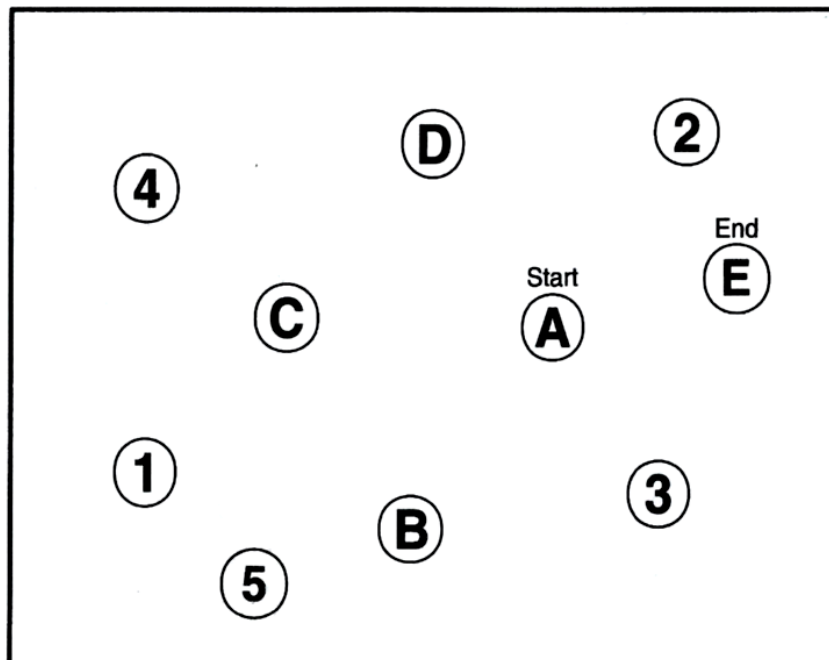
Examiner _____

Notes _____

Trail Making Test

Condition 3
Letter Sequencing

Practice

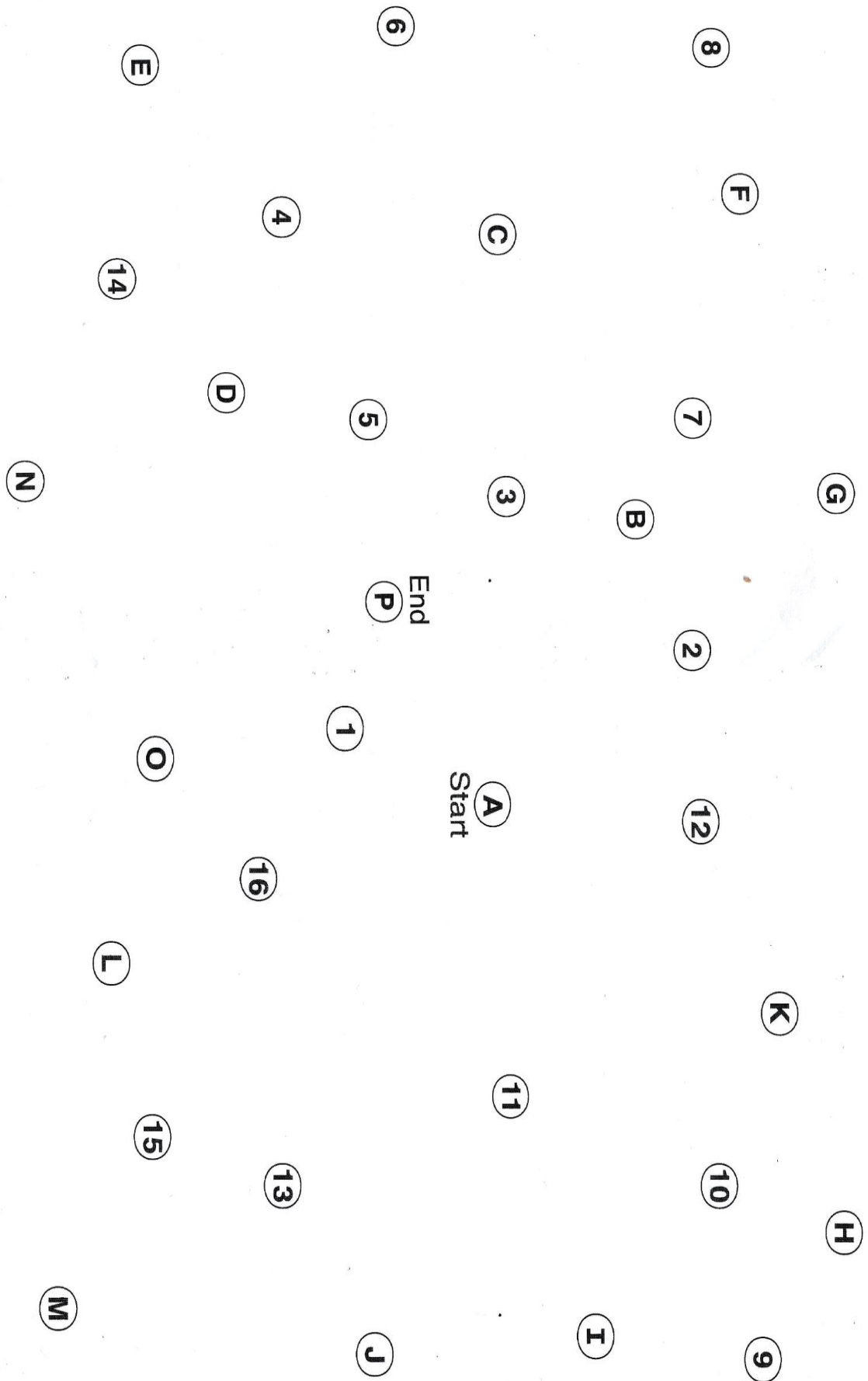


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Name _____ Age _____

ID _____ Date _____

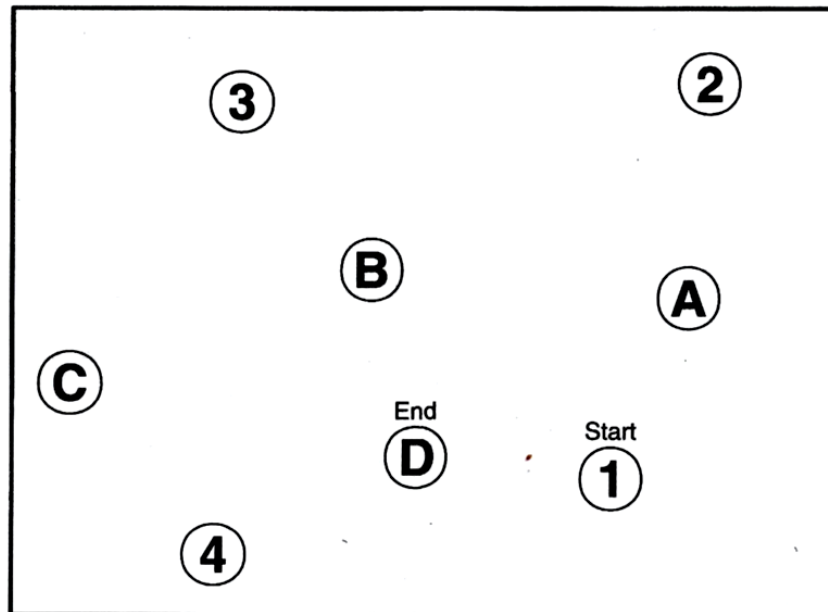
Examiner _____

Notes _____

Trail Making Test

Condition 4
Number - Letter Switching

Practice

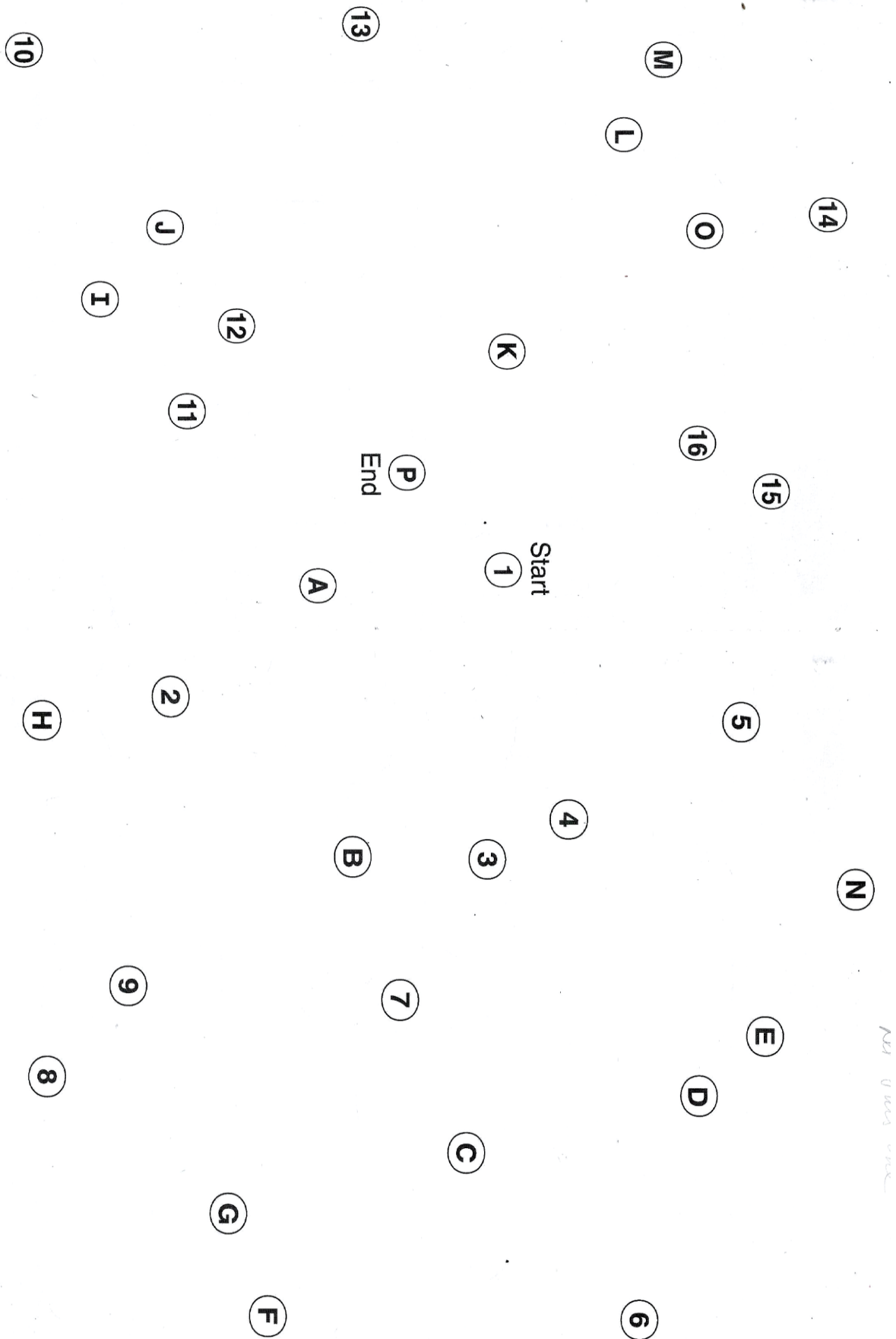


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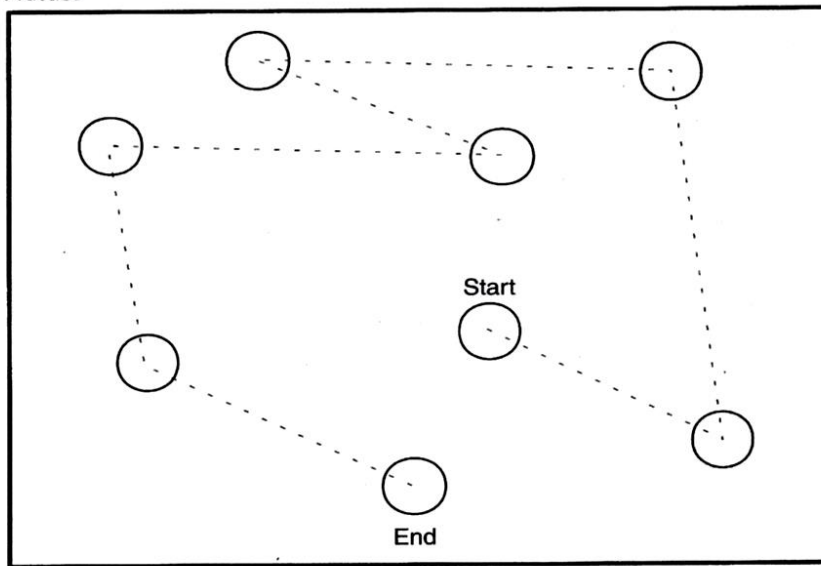


Name _____ Age _____
ID _____ Date _____
Examiner _____
Notes _____

Trail Making Test

Condition 5
Motor Speed

Practice

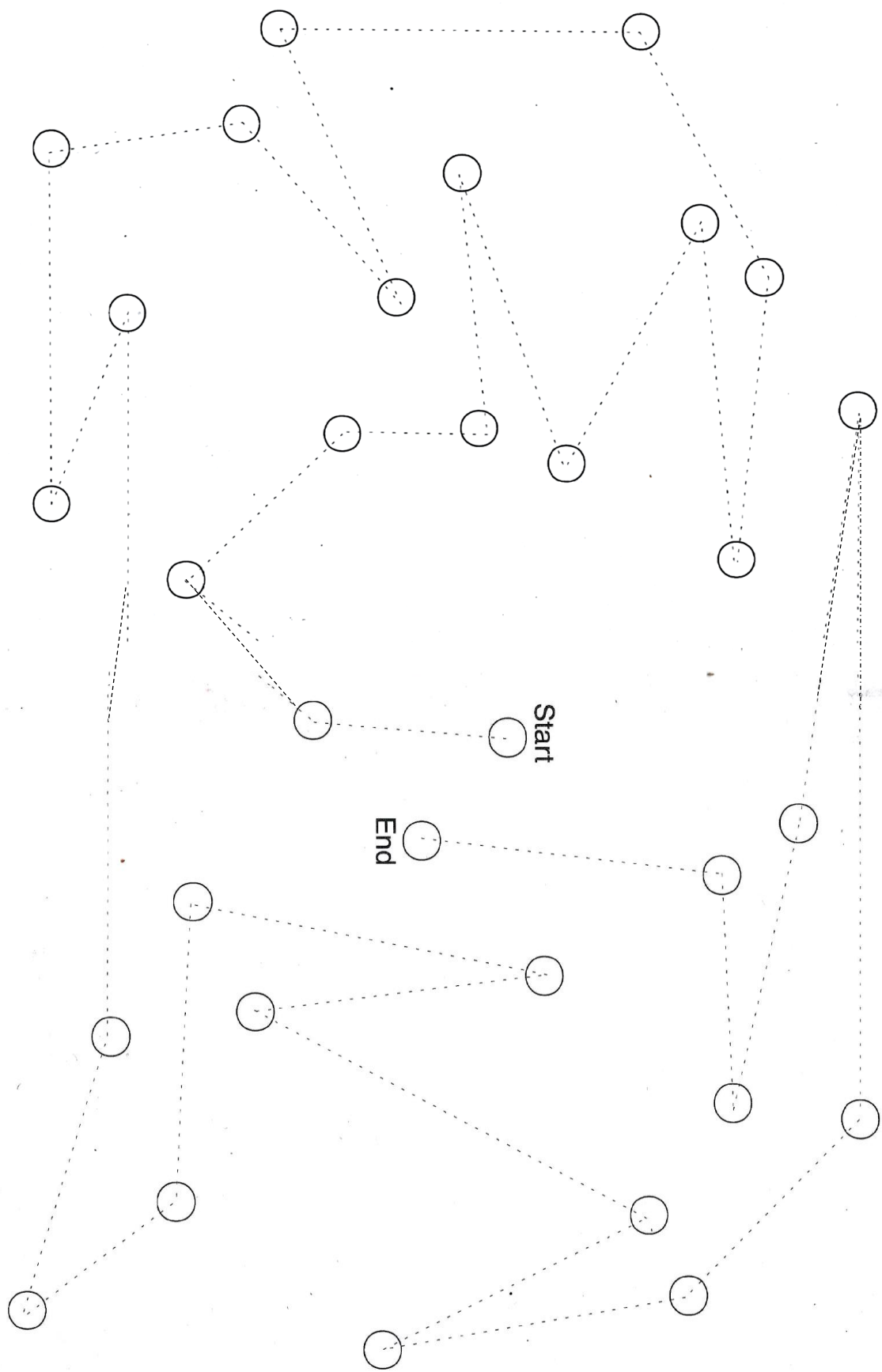


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Appendix 5: Digit Span

120 Digit Span

Item Administration

Forward

6-16 Items 1-9

Say, I'm going to say some numbers. Listen carefully, I can only say them one time. When I stop, you say them back to me in the same order. Just say what I say. Proceed to Item 1.

Administer Trial 1 and Trial 2 of each item. Proceed to the next item if the discontinuance criterion has not been met.

Administer Backward and Sequencing regardless of the child's performance on Forward.

Correct Responses (Forward)

Item	Trial
1.	2-9
	5-4
2.	3-9-6
	6-5-2
3.	5-4-1-7
	9-1-6-8
4.	8-2-1-9-6
	7-2-3-4-9
5.	5-7-3-6-4-8
	3-8-4-1-7-5
6.	2-1-8-9-4-3-7
	7-8-5-2-1-6-3
7.	1-8-4-2-7-5-3-6
	2-7-9-6-3-1-4-8
8.	7-2-6-1-9-4-8-3-5
	4-3-8-9-1-7-5-6-2
9.	6-2-5-3-1-9-8-5-4-7
	9-4-3-8-7-5-2-9-6-1

124 Digit Span

Correct Responses (Sequencing)

Item	Trial	Correct Response
SA.	3-1	1-3
	8-6	6-8
SB.	5-2-4	2-4-5
	4-3-3	3-3-4
1.	4-1	1-4
	3-2	2-3
2.	5-2-7	2-5-7
	1-8-6	1-6-8
3.	7-5-8-1	1-5-7-8
	4-2-9-3	2-3-4-9
4.	1-5-6-2-8	1-2-5-6-8
	2-8-4-7-9	2-4-7-8-9
5.	3-3-6-1-5	1-3-3-5-6
	4-9-4-6-9	4-4-6-9-9
6.	8-5-2-5-3-7	2-3-5-5-7-8
	6-1-4-7-9-3	1-3-4-6-7-9
7.	9-7-9-6-2-6-8	2-6-6-7-8-9-9
	3-1-7-5-1-8-5	1-1-3-5-5-7-8
8.	6-9-6-2-1-3-7-9	1-2-3-6-6-7-9-9
	1-4-8-5-4-8-7-4	1-4-4-4-5-7-8-8
9.	2-5-7-7-4-8-7-5-2	2-2-4-5-5-7-7-7-8
	9-1-8-3-6-3-9-2-6	1-2-3-3-6-6-8-9-9

122 Digit Span

Correct Responses (*Backward*)

Item	Trial	Correct Response
S.	9-4	4-9
	5-6	6-5
1.	2-1	1-2
	1-3	3-1
2.	3-9	9-3
	8-5	5-8
3.	2-3-6	6-3-2
	5-4-1	1-4-5
4.	4-5-8	8-5-4
	2-7-5	5-7-2
5.	7-4-5-2	2-5-4-7
	9-3-8-6	6-8-3-9
6.	2-1-7-9-4	4-9-7-1-2
	5-6-3-8-7	7-8-3-6-5
7.	1-6-4-7-5-8	8-5-7-4-6-1
	6-3-7-2-9-1	1-9-2-7-3-6
8.	8-1-5-2-4-3-6	6-3-4-2-5-1-8
	4-3-7-9-2-8-1	1-8-2-9-7-3-4
9.	3-1-7-9-4-6-8-2	2-8-6-4-9-7-1-3
	9-8-1-6-3-2-4-7	7-4-2-3-6-1-8-9

Sequencing

Qualifying Item

Say, Count to five out loud so I can hear you.

If it appears that the child does not understand, say, Count, like this, 1...2... (pause between each number). Now you try. Allow the child to respond.

Correct response [correctly counts to at least 3]: Proceed to Sample Item A.

Incorrect response: Discontinue the subtest.

Appendix 6: Reading Comprehension Assessment Tool (RCAT)

Instructions: Read the three passages below carefully and answer questions that follow:

Part One (5 Marks)

The Zambian Highway Code

The high way code is an official book that provides guidelines to all drivers using the Zambian roads. The high way code is provided for in the traffic and road safety act of 1998. It contains rules and sufficient advice for all road users. Any driver who disobeys rules contained in the high way code is fined or disqualified from driving. The Highway Code forbids anyone to drive a car without a driver's licence, driving while drunk, over speeding or allowing a child to occupy the front seat. The high way code also contains ten (10) basic rules for driving and all drivers should adhere to them without fail.

Zambia has recorded an increase in road traffic accidents annually and this has prompted the Zambian Government to put up measures to improve road safety among road users. The Government through the Road Transport and Safety Agency (RTSA) has embarked on Road safety awareness campaigns to educate the masses on importance of road safety. The Road Transport and Safety Agency (RTSA) work in collaboration with the Zambia police to ensure compliance to road safety guidelines. The 21st century advocates for digitalised road safety control mechanisms. To adhere to the 21st century digitalised road safety control mechanisms, the Zambian Government has introduced digitalised speed trap cameras to regulate motorists from over speeding. Corrupt insurance of driving licences to incompetent people, overloading, non- compliance to the high way code and allowing vehicles that are not road worthy on the roads are the four main factors that contribute to increase in road traffic accidents.

Answer the following questions:

1. What has the Zambian Government done to adhere to the 21st century advocacy for digitalised road safety control mechanisms?

.....
.....

2. State any one thing forbidden by the high way code as indicated in the passage?

.....
.....

3. Name any Government institution that ensures compliance to road safety rules?
.....
.....
4. What penalty can be given to a driver who disobeys rules contained in the high way code?
5. List any major factor that contribute to road traffic accidents according to the passage?.....
.....

Part Two (5 Marks)

Instructions: Read the passage bellow carefully and answer questions that follow:

The Cruel King

Long ago in Central province, there lived a wicked Chief by the name of Chibomba Ndongwe. He was the king for Lusekelo kingdom. He was very cruel to his people and made them to pay high taxes so that he could be rich. One year, his kingdom was hit by droughts and everyone recorded bad harvest in the area. Hunger erupted in Lusekelo kingdom but Chief Chibomba Ndongwe decided to increase the taxes which people were paying. He grabbed children of people who failed to pay tax and sold them as slaves to white men from German. The people of Lusekelo kingdom called for a meeting to engage their king to reduce the high taxes due to hunger experienced in the area. The king ordered his guards to beat and arrest all the people who assembled for that particular meeting. The lucky ones managed to run away and escaped.

One day, Chief Chibomba Ndongwe fell sick to a point of death. He decided to call a witch doctor so that he could tell him what caused his sickness. The witch doctor told Chief Chibomba Ndongwe that the ancestral spirits were annoyed because of the way he mistreated the people of Lusekelo kingdom. The witch doctor informed the king that he needed to reconcile with the people of Lusekelo kingdom or else he would die. Chief Chibomba Ndongwe summoned all the people of Lusekelo kingdom to come to the palace for reconciliation meeting. The chief informed the people of Lusekelo kingdom that they would no longer be required to pay tax to him. He also informed them that the whites from German have been instructed to return all children who were sold as slaves. People of Lusekelo reconciled with their chief and were very happy. Chief Chibomba Ndongwe got healed just after the reconciliation meeting and thanked the people of Lusekelo kingdom for their cooperation. This story teaches that

leaders should listen to people's concerns, should not impose laws and mistreat the people they are leading.

Answer the following questions:

6. What did Chief Chibomba Ndongwe do when hunger erupted in Lusekelo kingdom?
.....
.....
7. What punishment did Chief Chibomba Ndongwe impose to people of Lusekelo kingdom who failed to pay tax?
.....
.....
8. What was the cause for Chief Chibomba Ndongwe's sickness?
.....
.....
9. Name one thing that Chief Chibomba Ndongwe informed the people of Lusekelo kingdom during the reconciliation meeting?
.....
.....
10. According to the passage, what lesson can the readers learn from the story?
.....
.....

Part Three (5 Marks)

Instructions: Read the passage below carefully and answer questions that follow:

Census

The Zambian government conducts census every after ten (10) years. Zambia's latest census of population and housing was conducted in 2010 between 16th October and 15th November, 2010. Complete counting in all parts of the country was achieved by 30th November, 2010. The 2010 census of population and housing marked the Fifth National population census that Zambia has successfully conducted since independence in 1964. Previous censuses were conducted in 1969, 1980, 1990, 2000 and 2010.

The Central Statistics Office (CSO) is a government department responsible for conducting census. A total of 3.2 million questionnaires were used to collect data from every individual

and household covered during the 2010 census. Central Statistics Office (CSO) used Optical Mark Reading (OMR) and Intelligent Character Recognition (ICR) to capture data during 2010 census of population and housing. Zambia's population in 2000 was 9, 885, 591 and 13, 092, 666 in 2010. The population of Zambia grew at an average annual rate of 2.8% between 2000 and 2010. The main objective of census is to provide accurate and reliable information on the size, composition and distribution of the population of Zambia.

Answer the following questions:

11. What is the main objective of census according to the passage?

.....
.....

12. What is the difference in Zambia's population between 2000 and 2010?

.....
.....

13. How many times has the Zambian government conducted census since 1964?

.....
.....

14. State the period in which the 2010 census of population and housing was conducted?

.....
.....

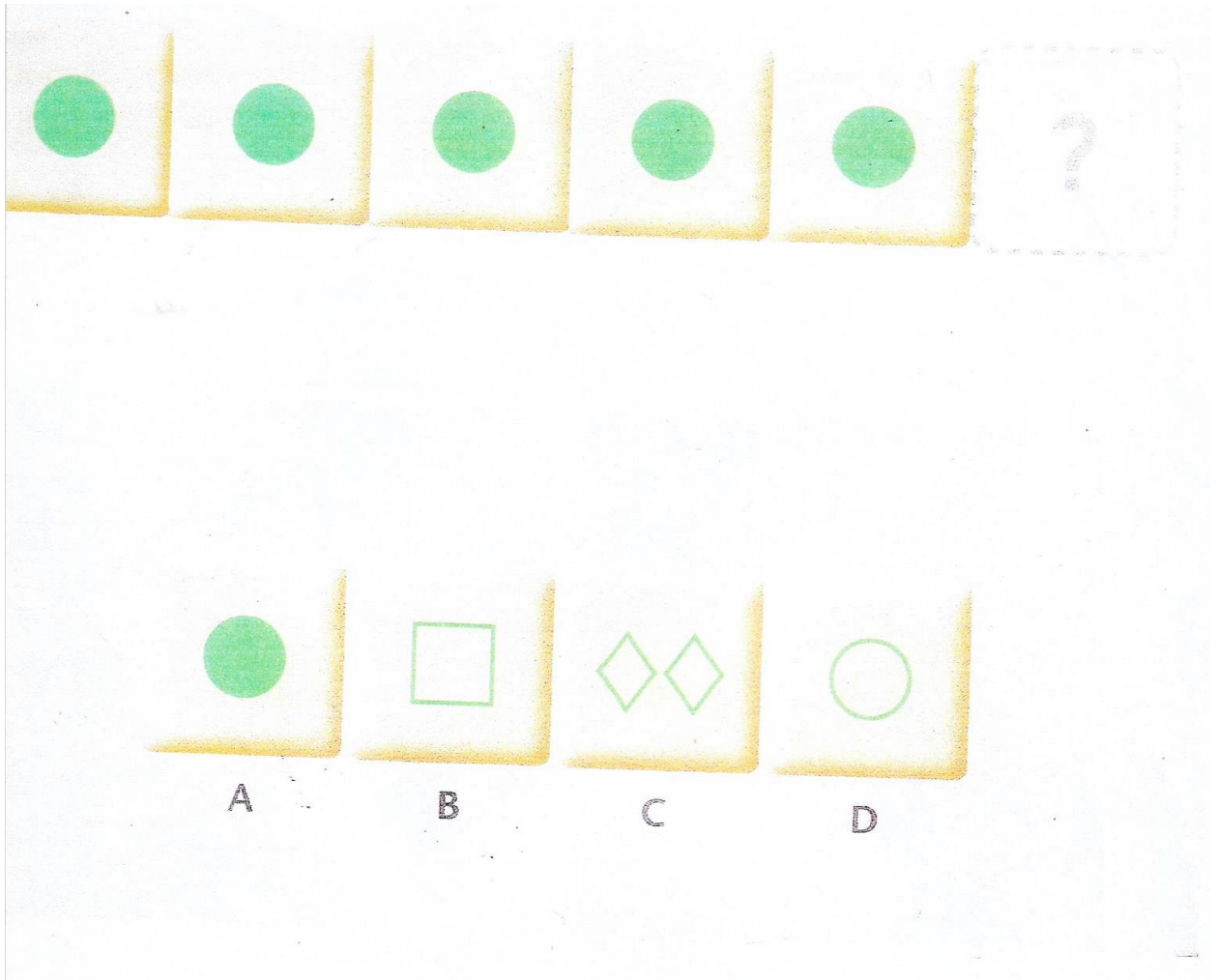
15. Name a government department which is responsible for conducting census in Zambia?

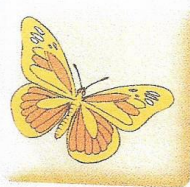
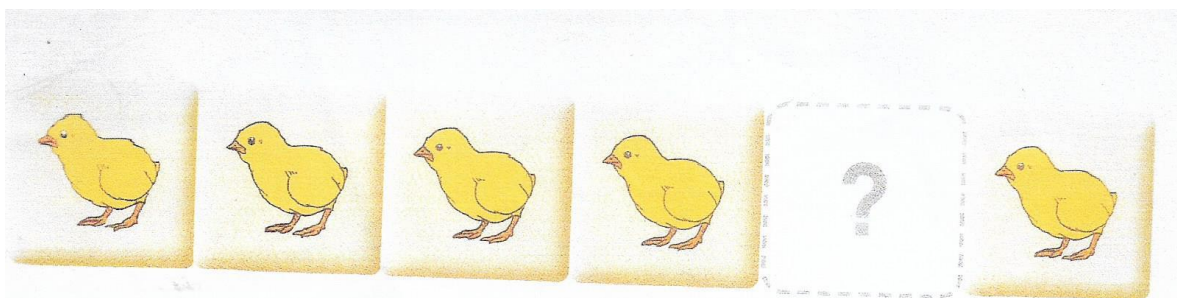
.....
.....

Thank you for your time

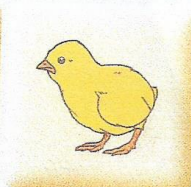
Appendix 7: Kaufman Pattern Reasoning Test (K-PRT)

KAUFMAN PATTERN REASONING





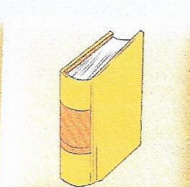
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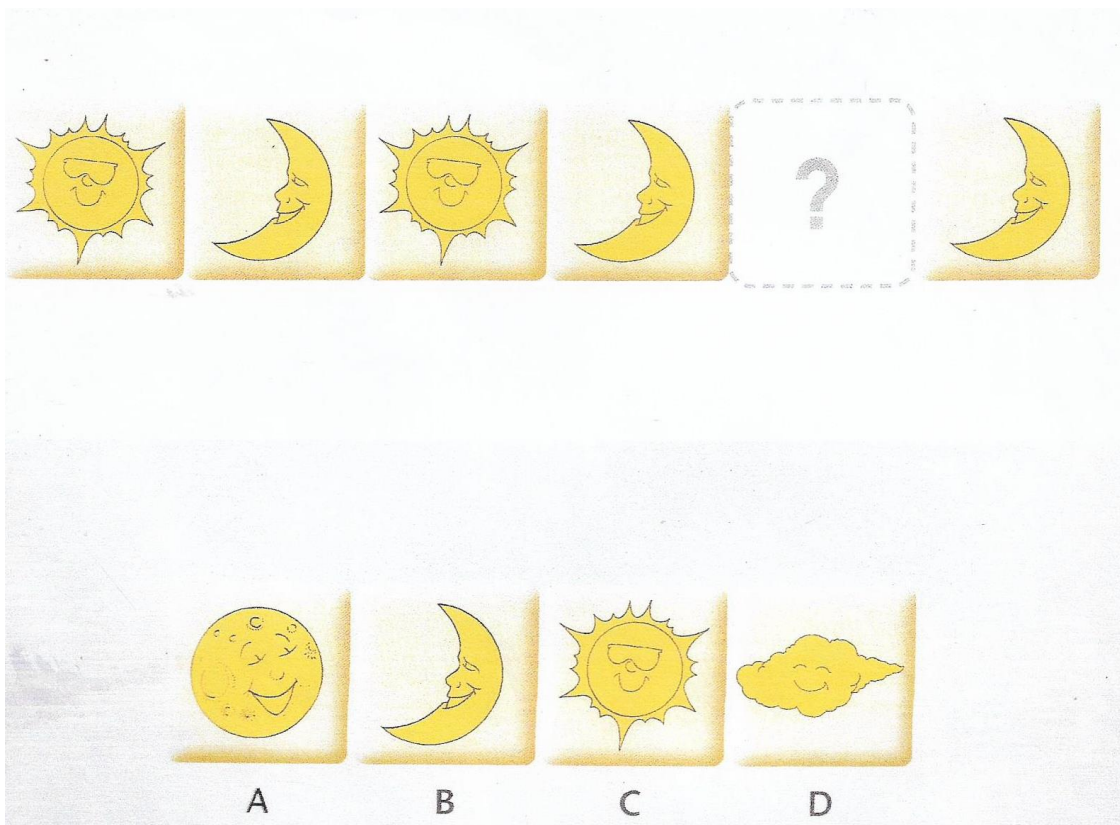
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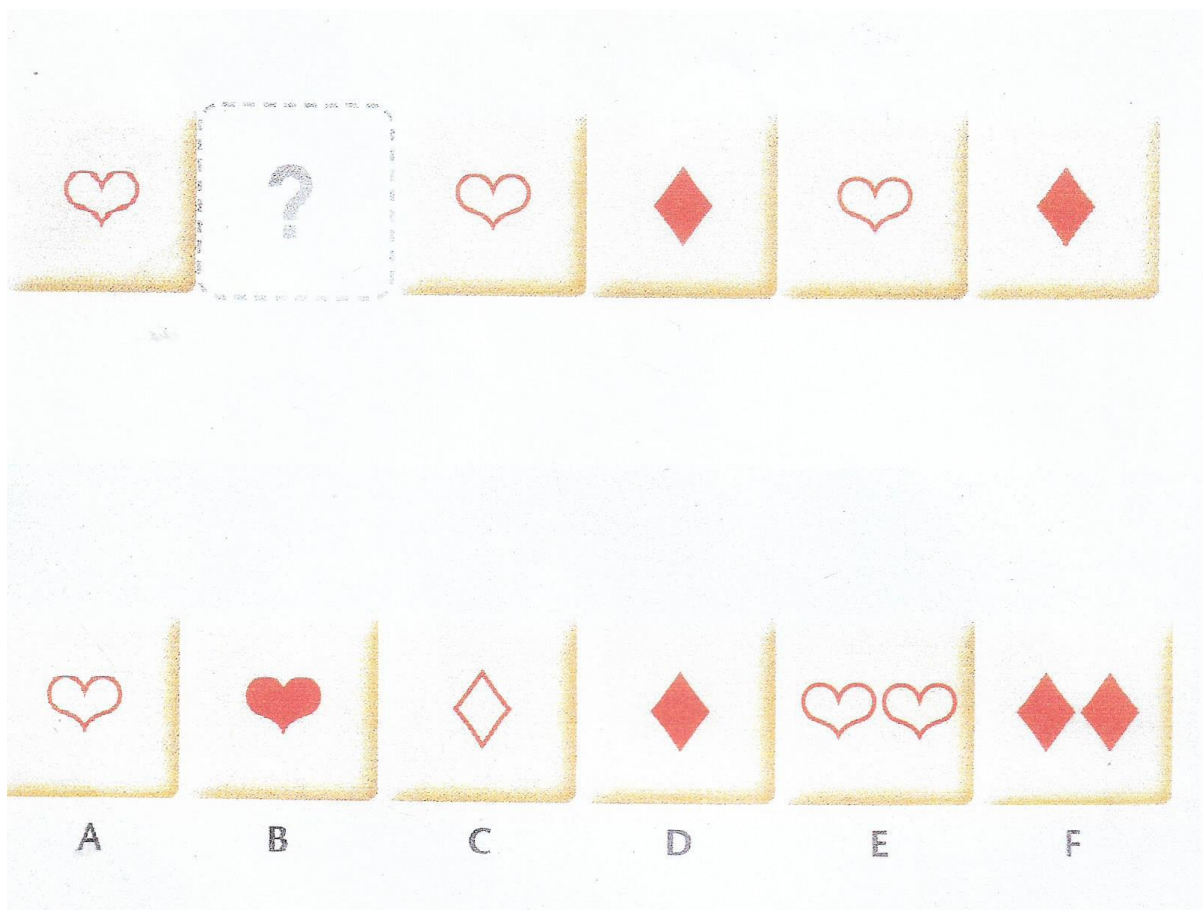


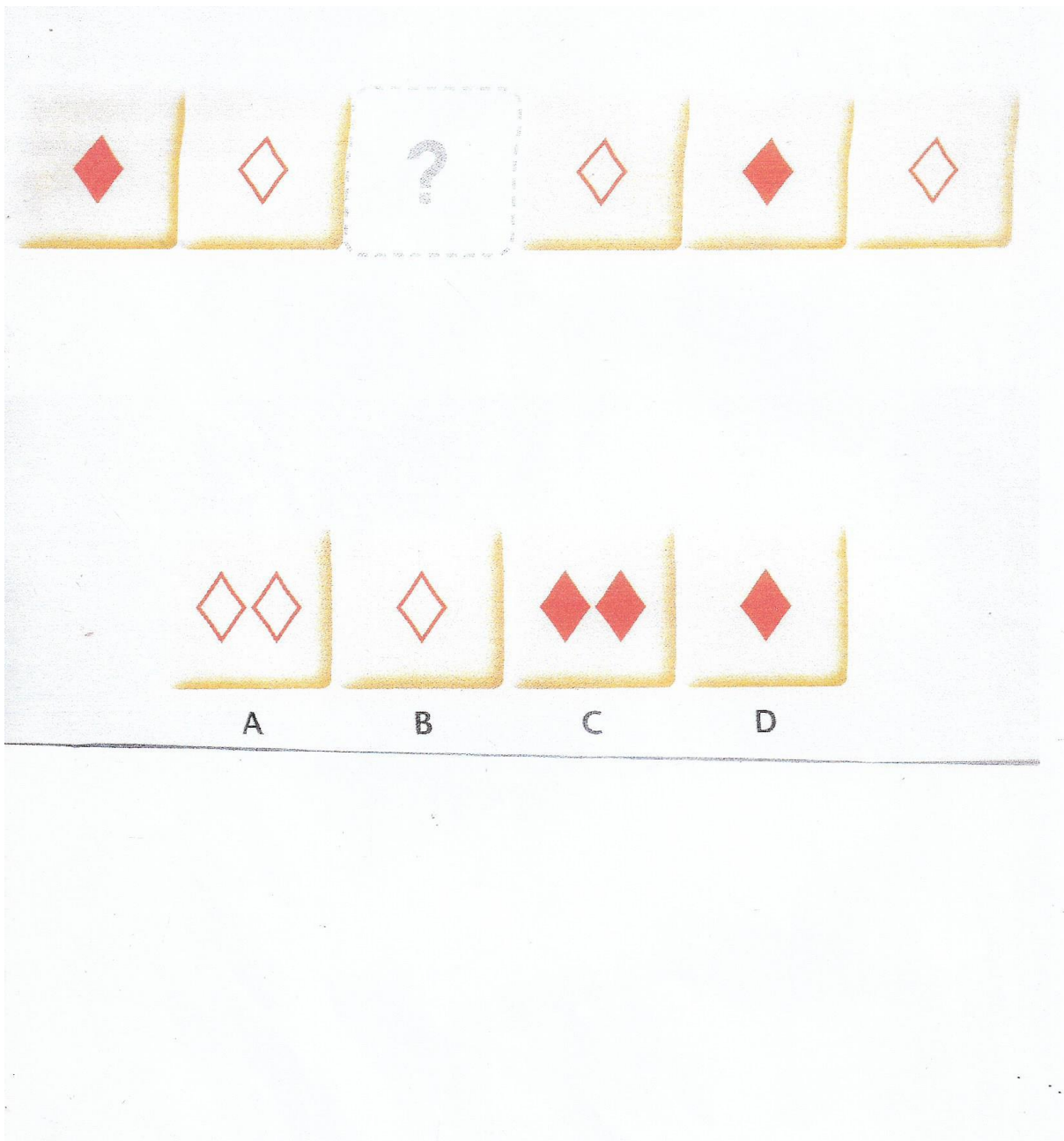
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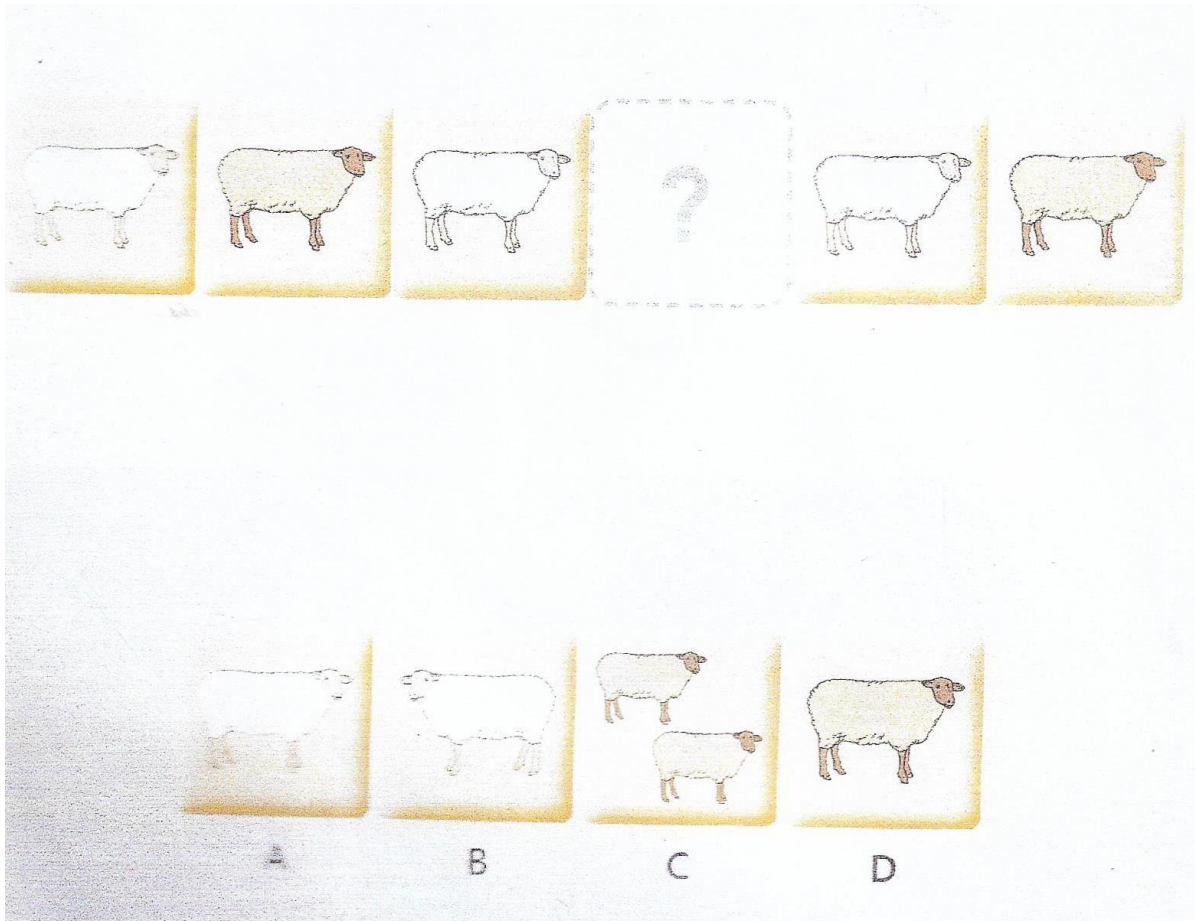


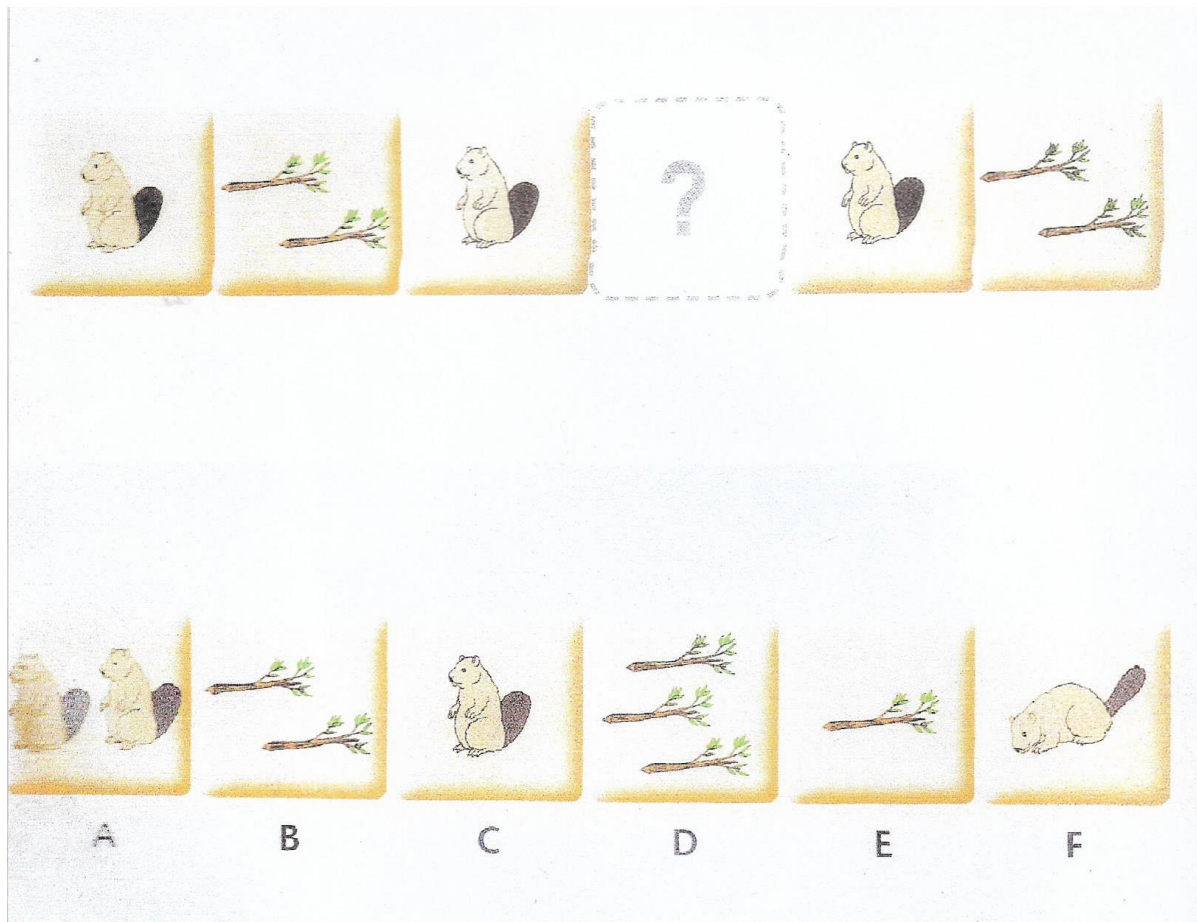
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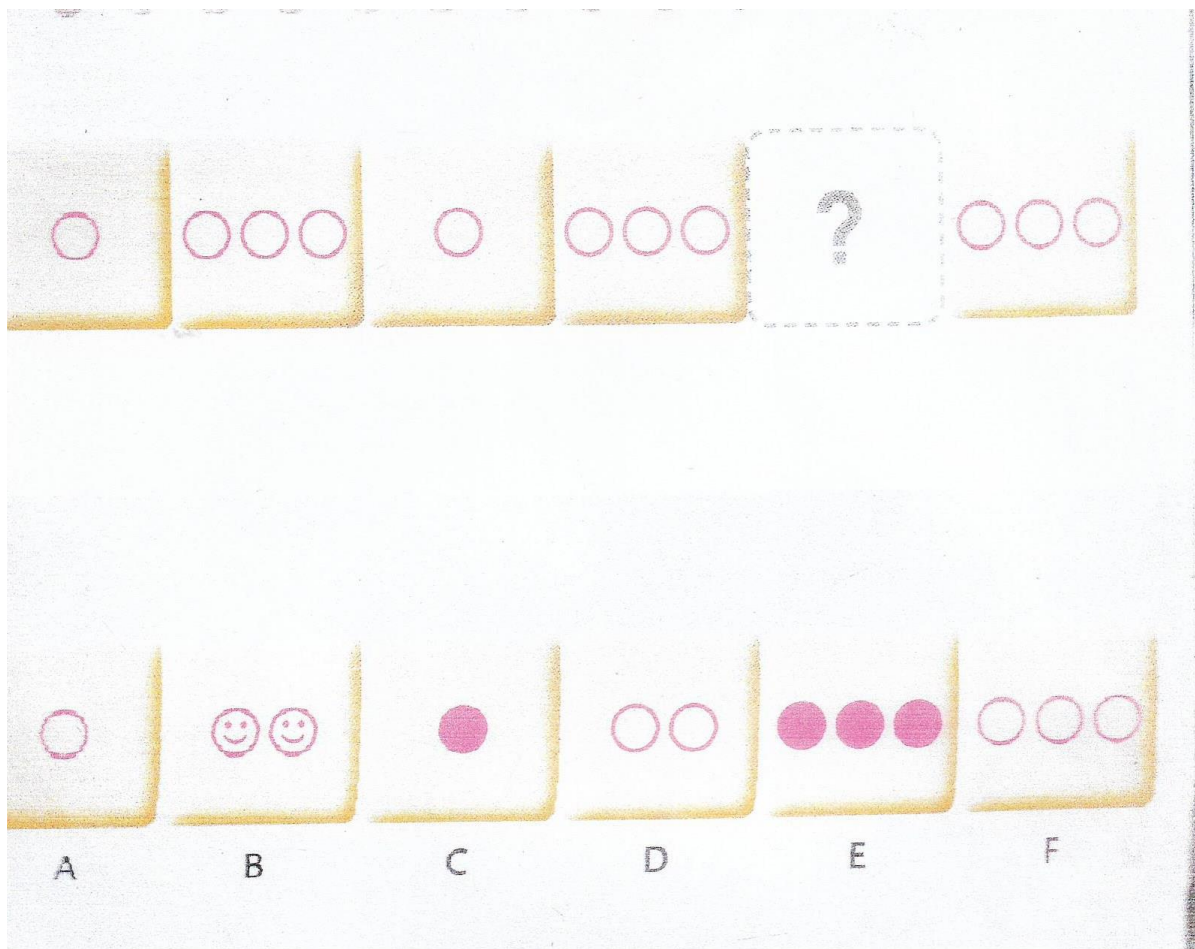


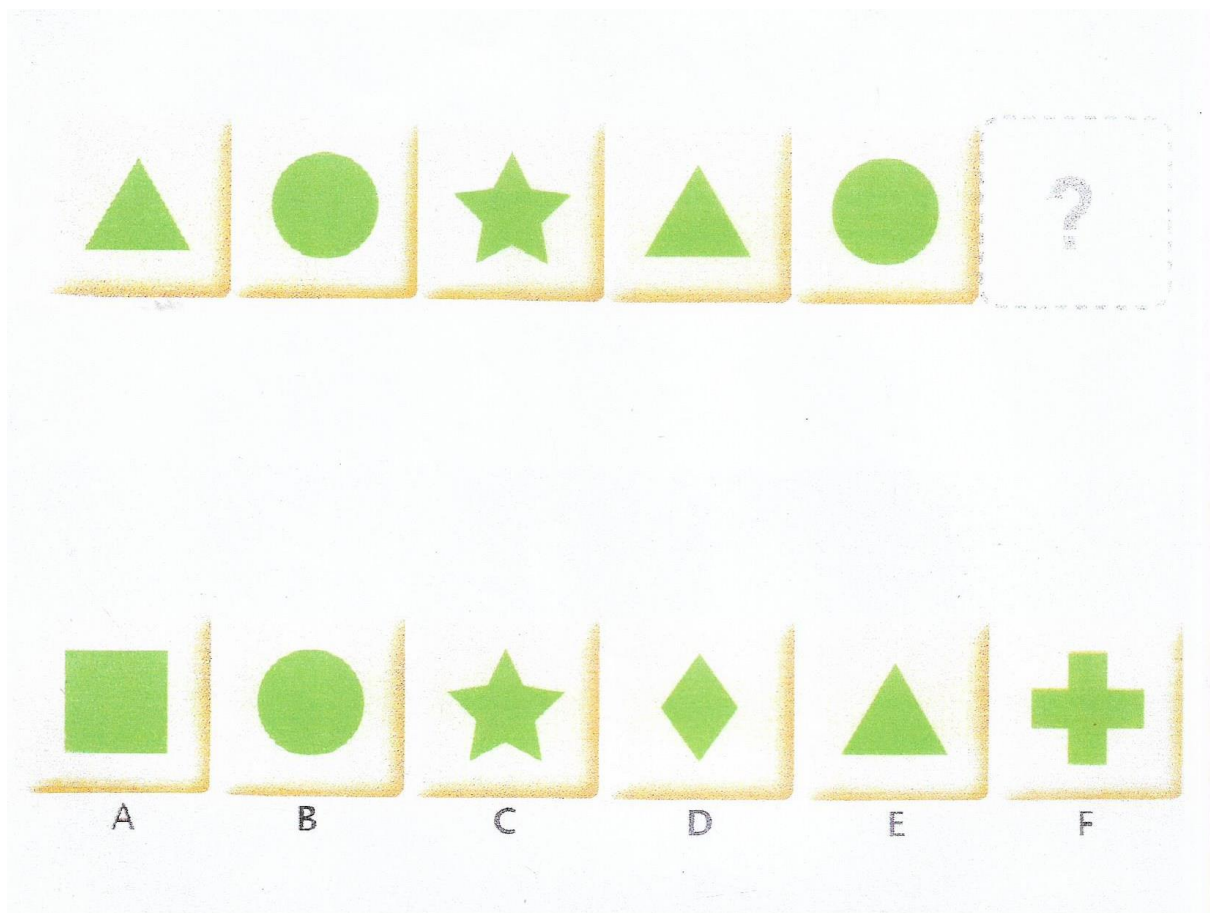


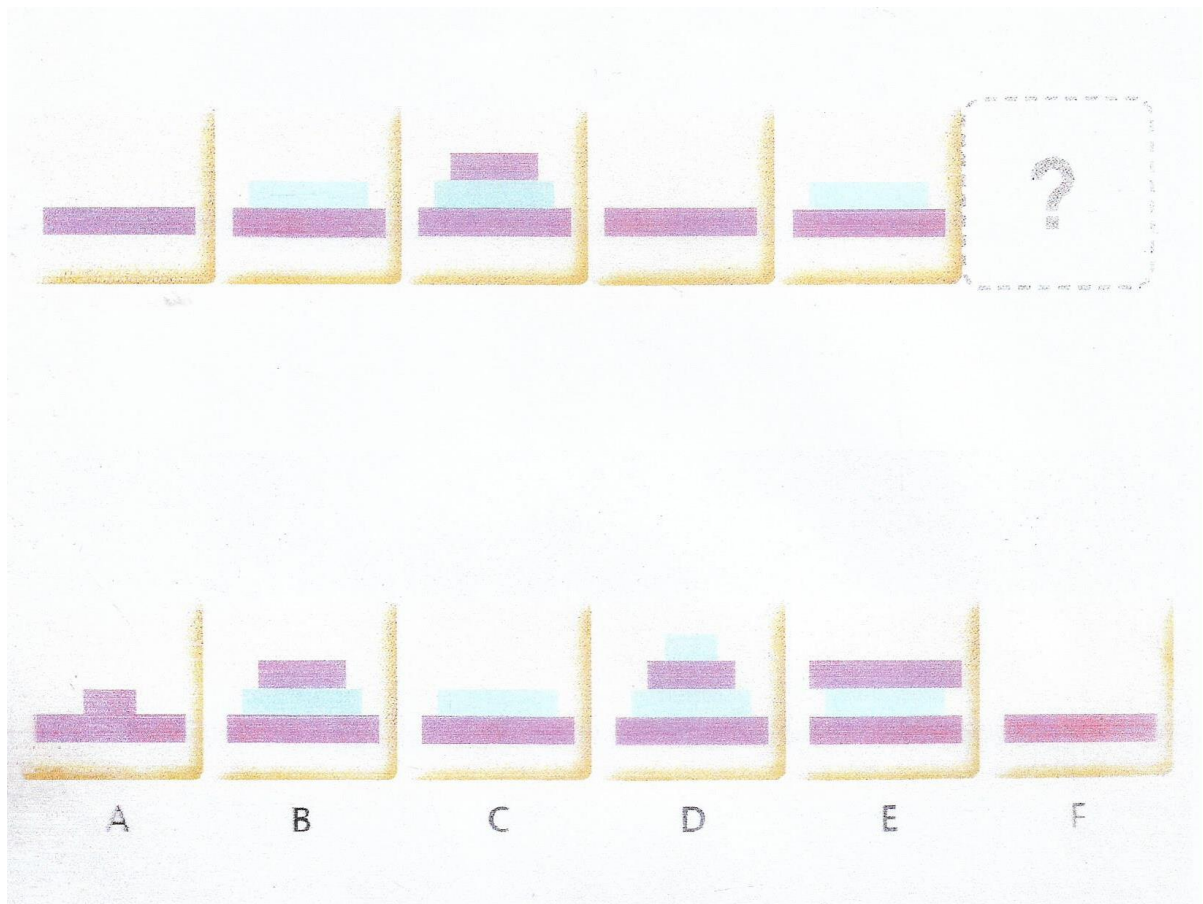


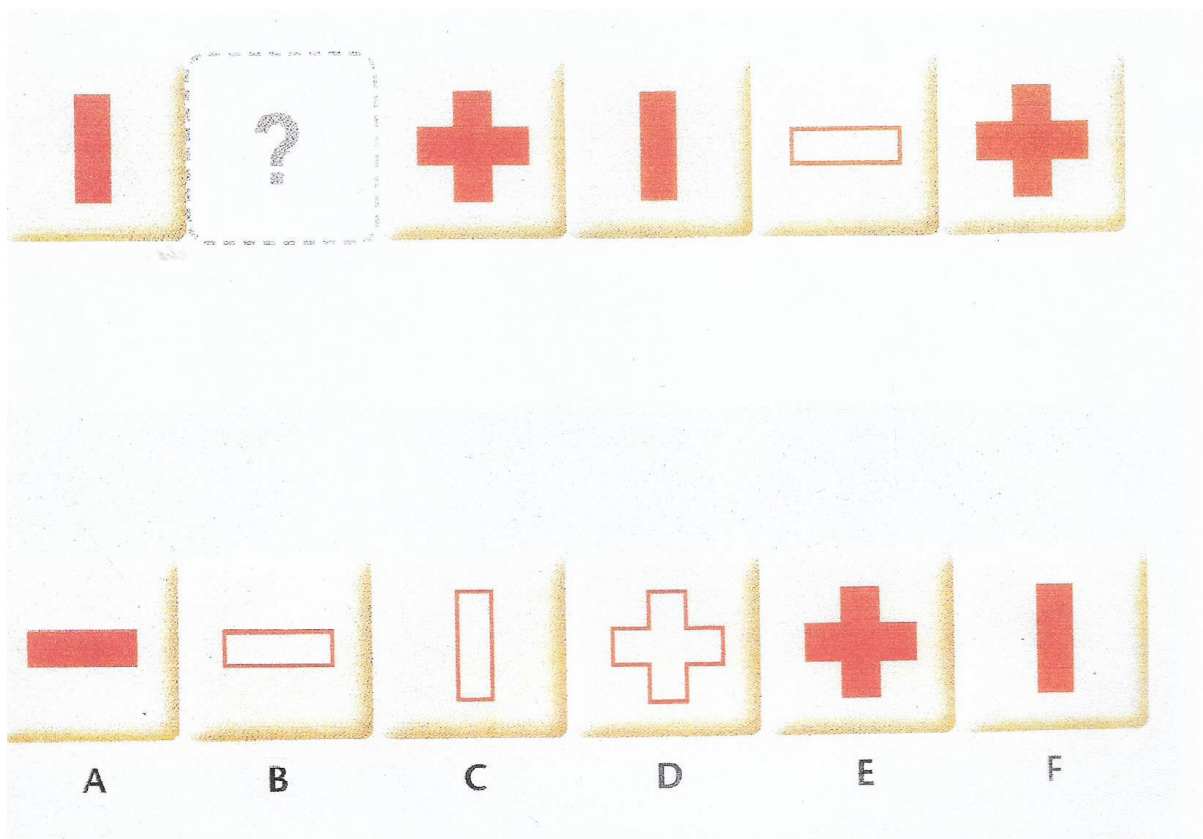


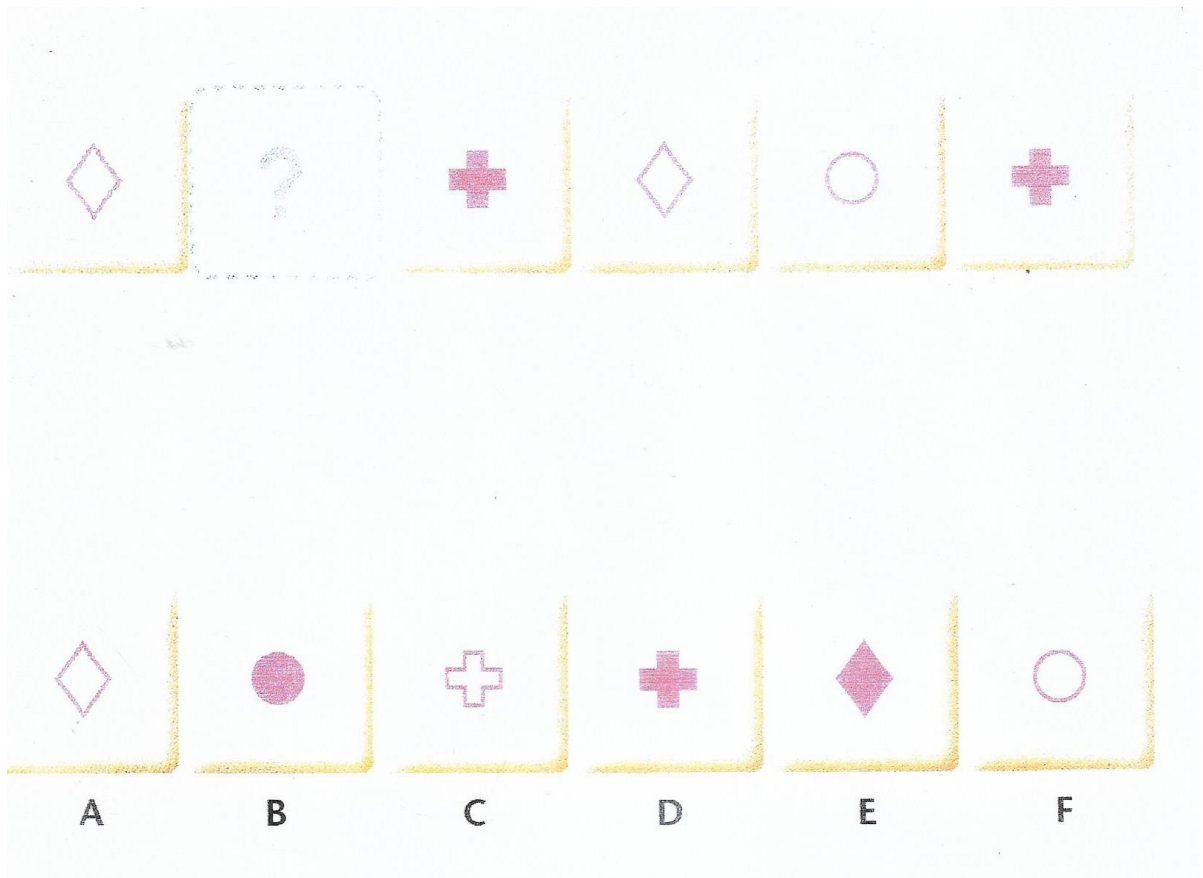


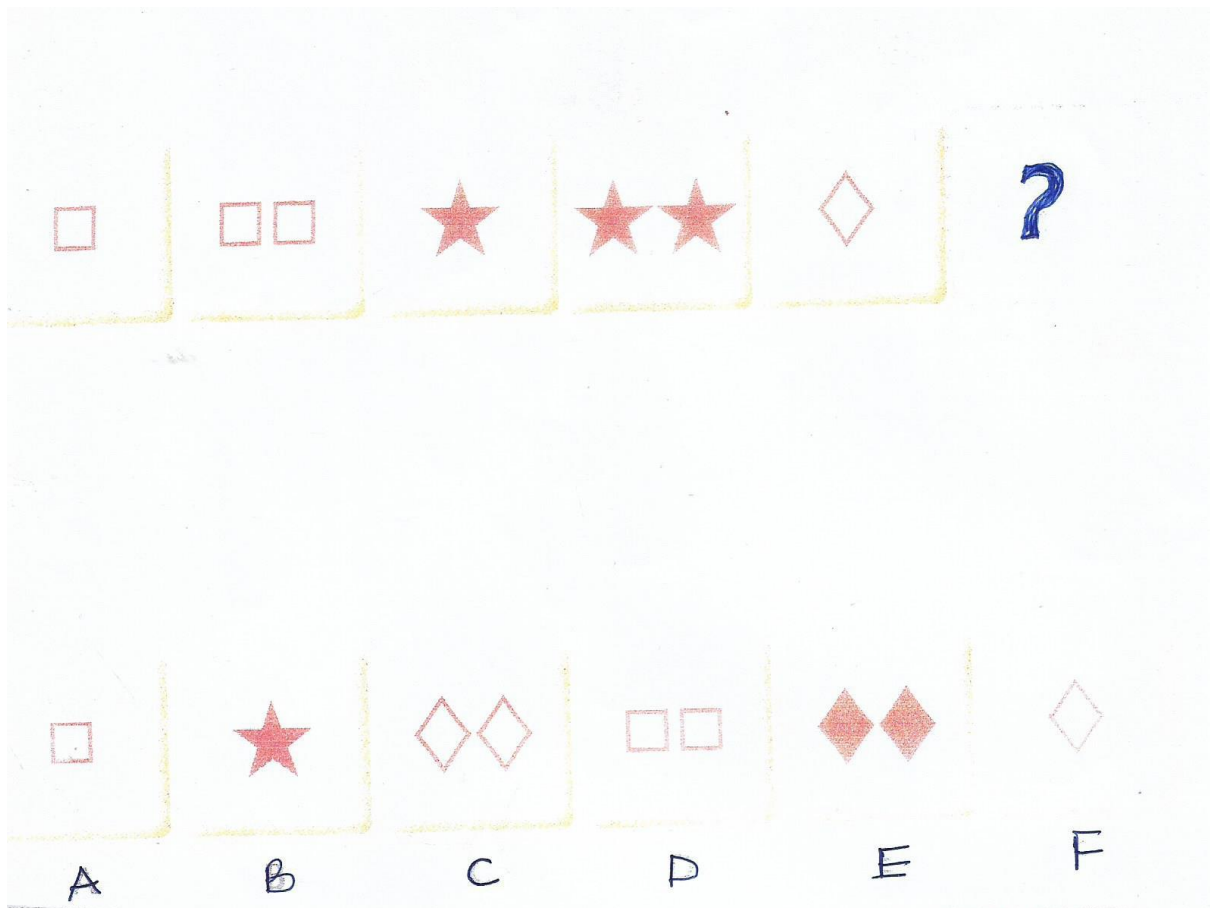


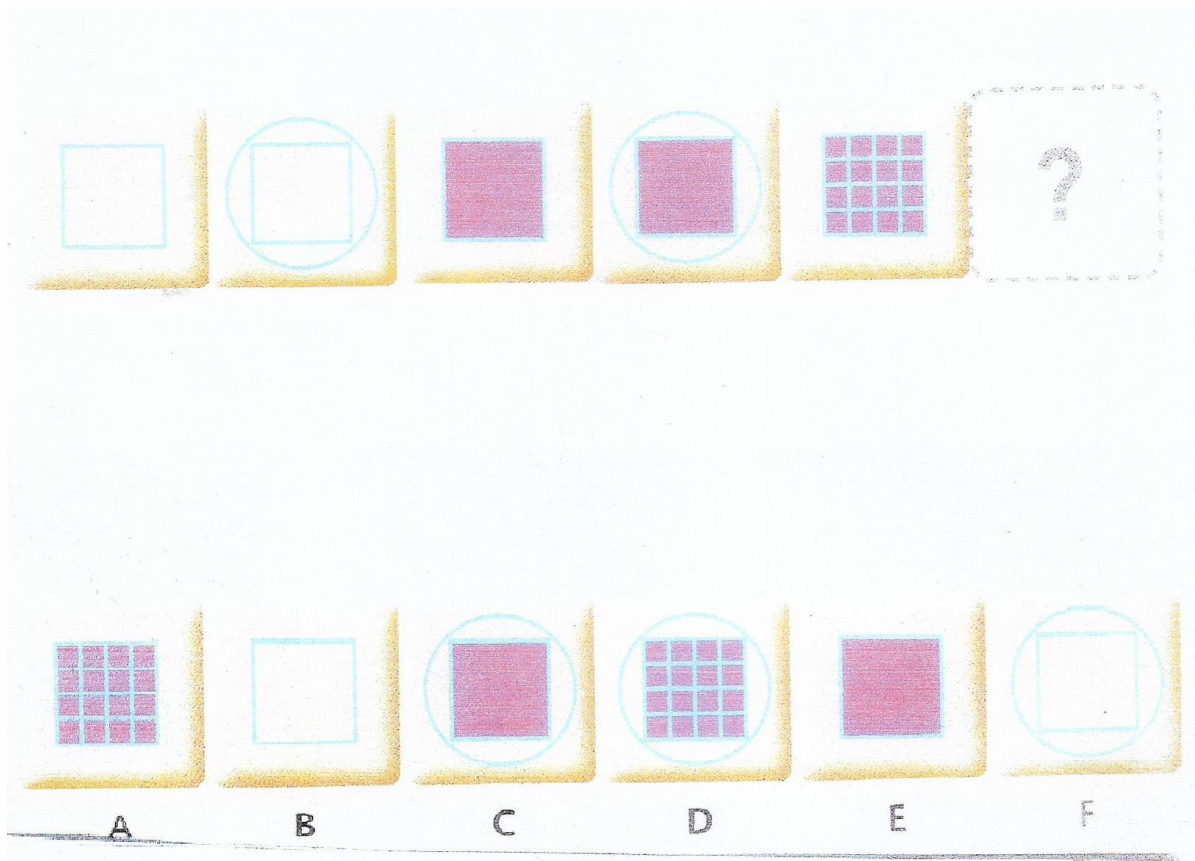


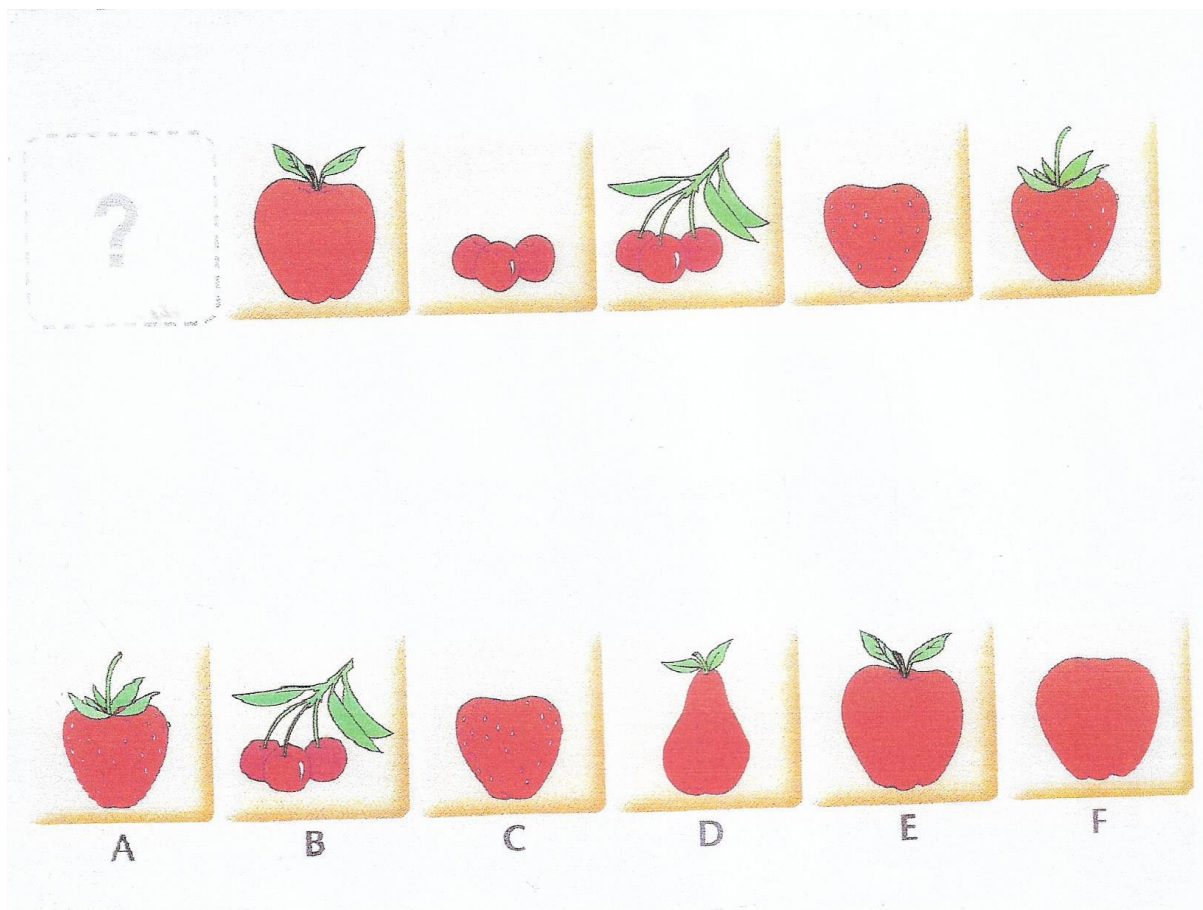


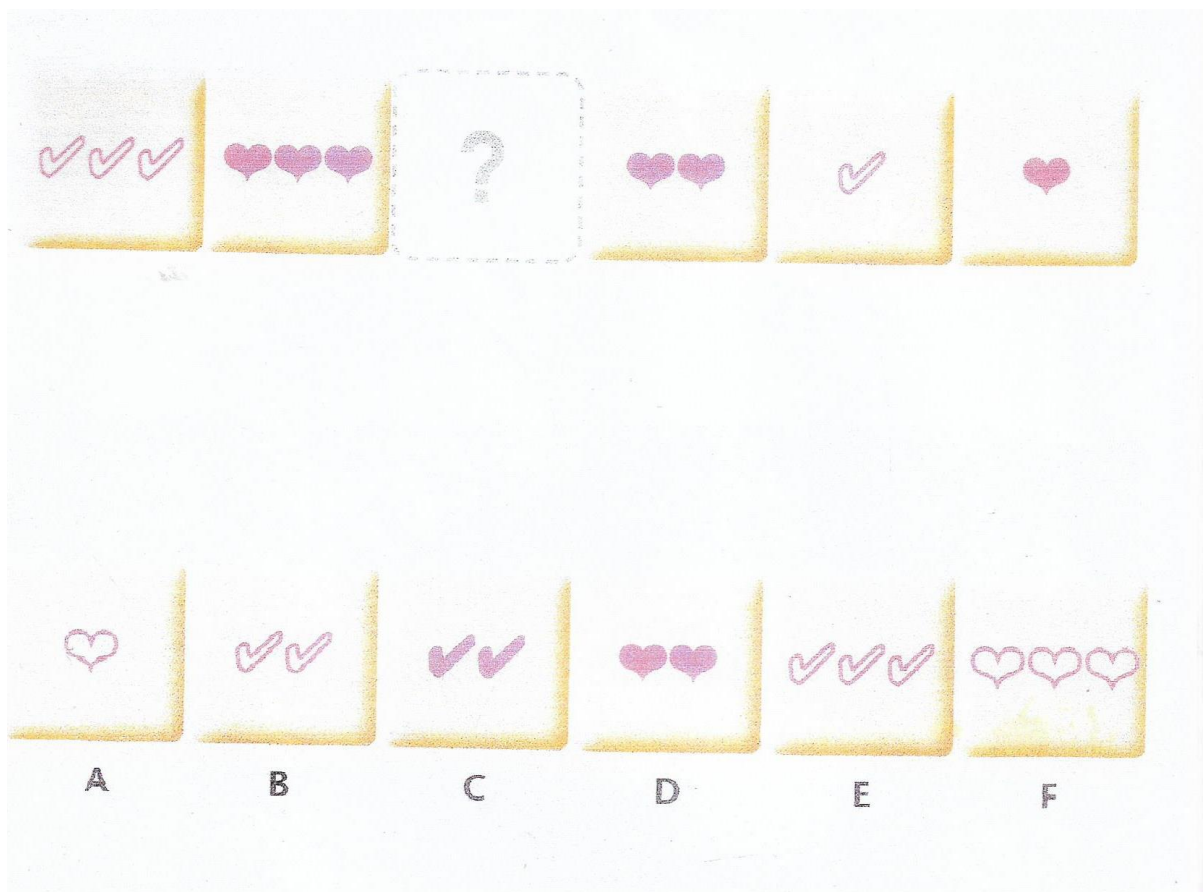


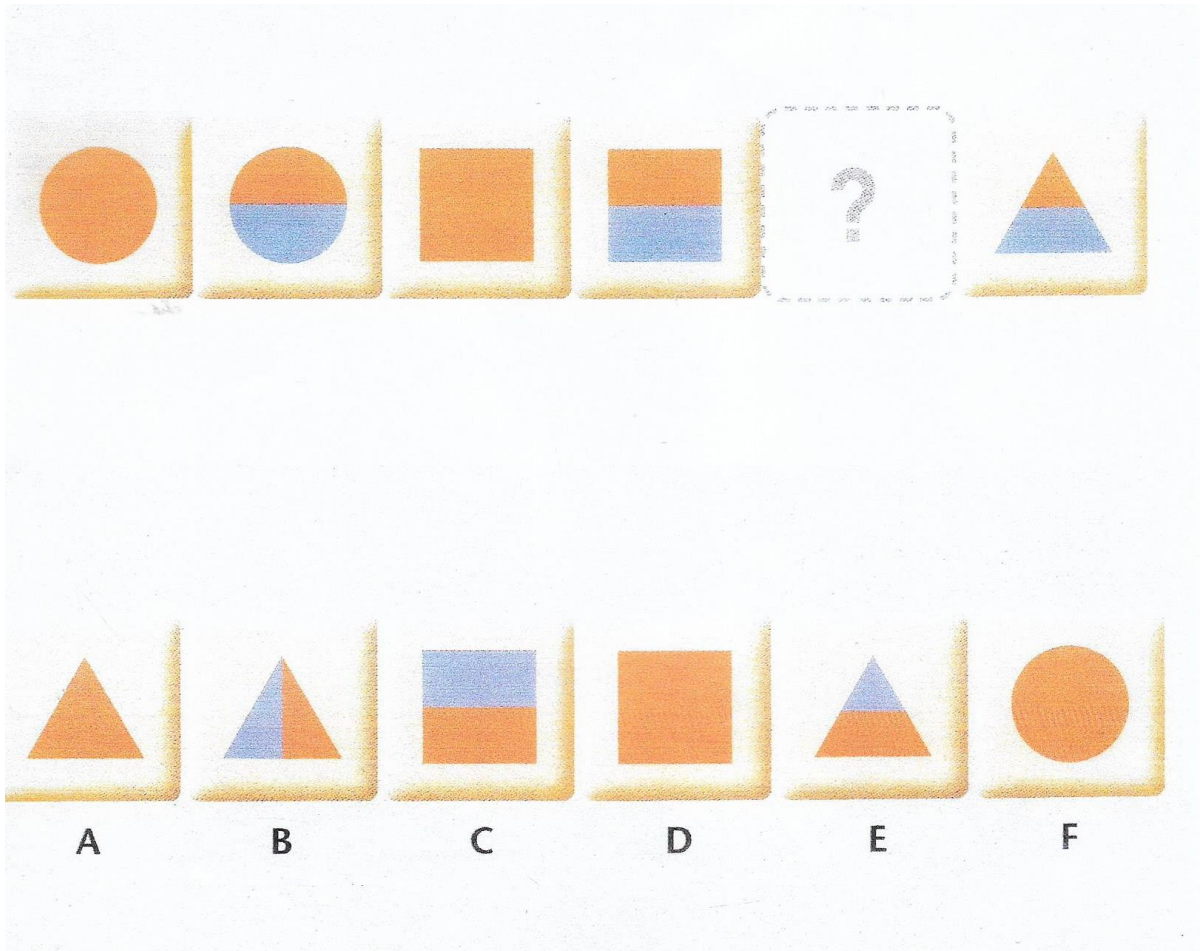


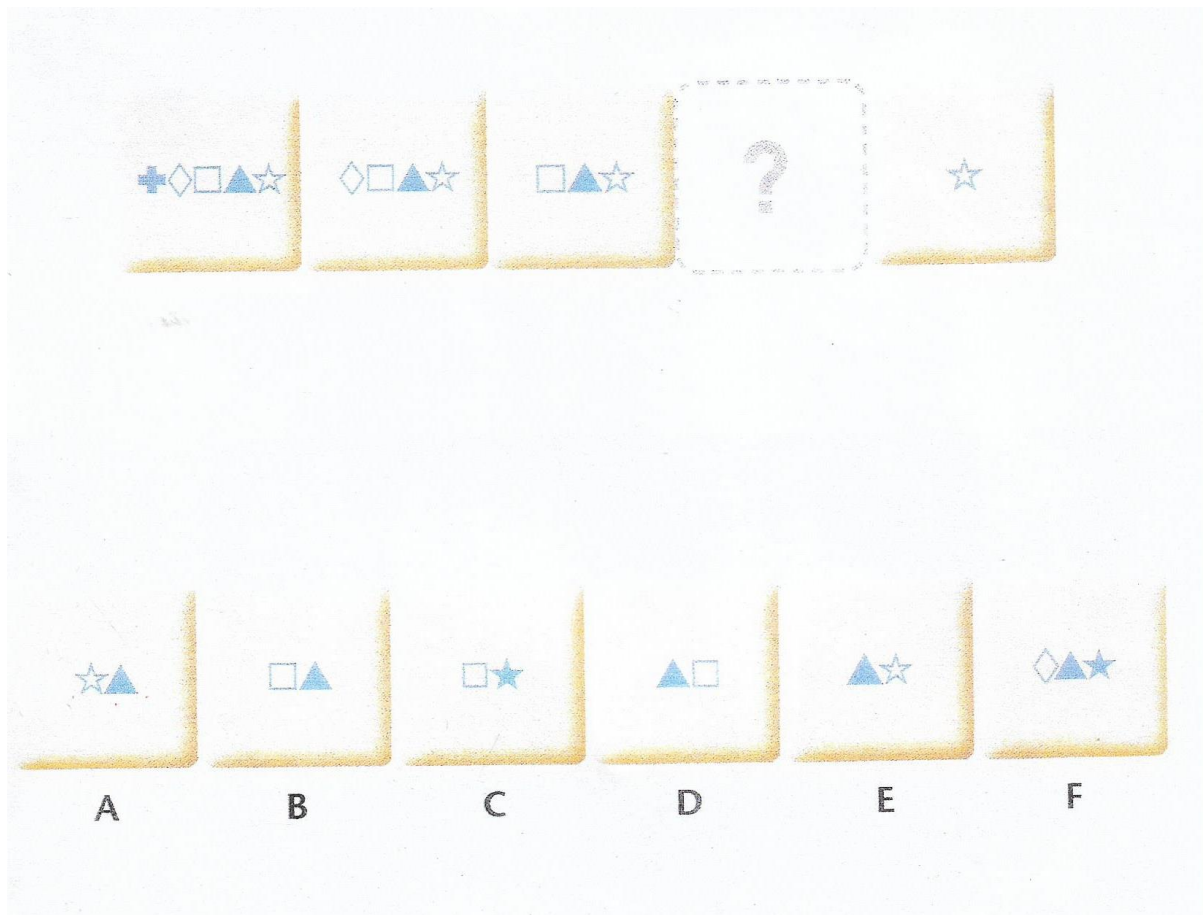


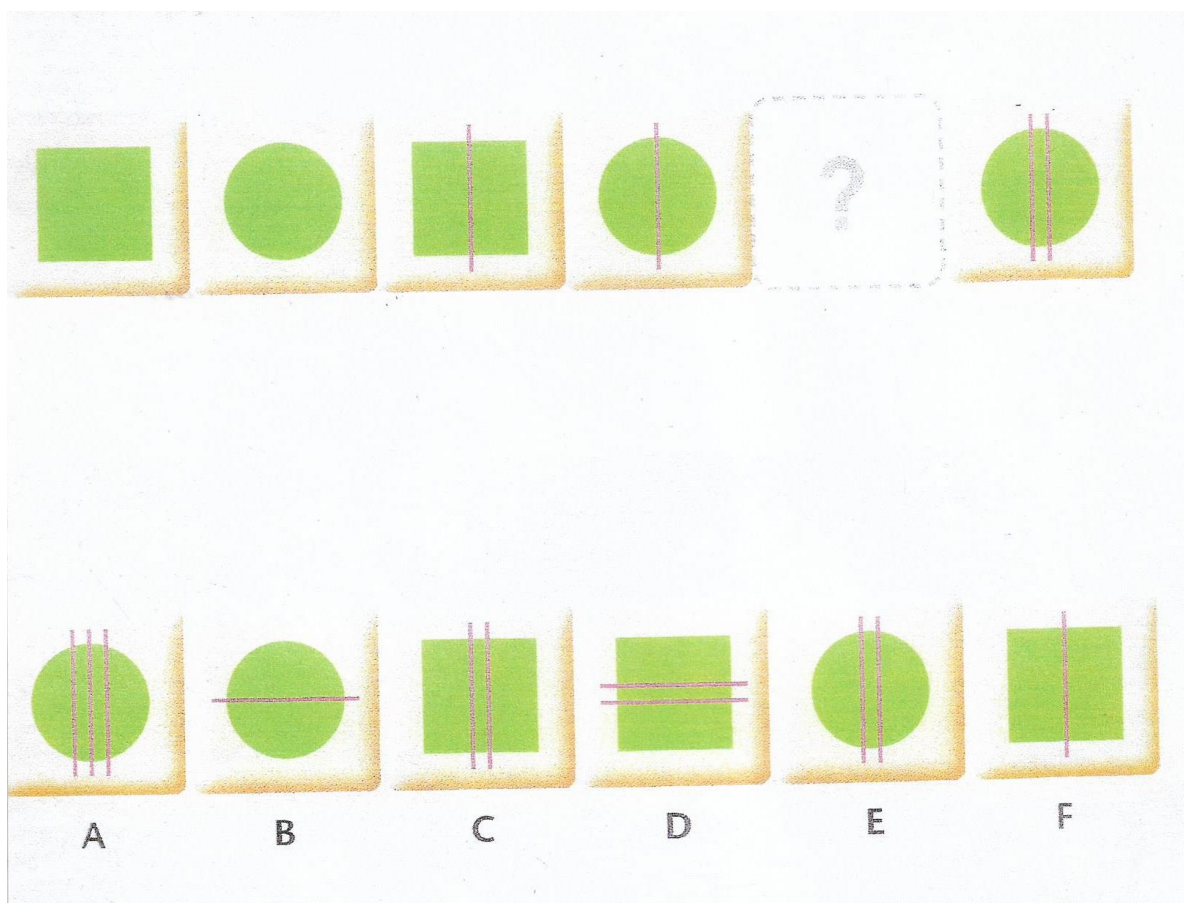












Appendix 8: Biographical Data Form for Parents/Guardians

Dear Parent/Guardian,

I am pleased to notify you that your child has been selected to participate in the study entitled “The Influence of Executive Functioning on Reading Comprehension among Grade Seven Pupils in Selected Primary Schools in Itzhi-tezhi District, Zambia” You are therefore required to fill this form as part of the requirements in the study and you are not required to write your name on this form.

District: **School:** _____

Parent’s ID: _____ **Child’s ID** _____ **Relationship to the child:** -----

SECTION 1

Q.1. What is your occupation? -----

Q.2. What is your Husband/wife’s occupation? _____

Q.3. In which residential area do you live? _____

Q.4. Did your child attend pre-school/nursery before starting grade one?

1. Yes [] 2.No []

Q.5 If the answer to the above is yes, name the school where your child went to _____

SECTION 2: HOME POSSESSIONS INDEX

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

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

Q.3. Do you have a stove in your home? 1. Yes [] 2. No [] Page **122** of **153**

Q.4. What is the source of power in your home? Hydroelectricity [] Solar [] Generator
(Thermal) []

Q.5. Do you have running water at home? 1. Yes [] 2.No []

Q.6. Do you have a flushable toilet? 1. Yes [] 2.No []

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

Q.8. Does your child have at least two pairs of clothes? 1. Yes [] 2.No []

Q.9. Does your child have at least one pair of shoes? 1. Yes [] 2.No []

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

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

Q.12. Do you own the house you are occupying? 1. Yes [] 2.No []

Q.12. How much is your monthly income? (Tick) K1 to K3000 [] K3001 to K10, 000 []
Above K10, 000 []

Q.13. How many animals (Cattle) do you have? Tick) 1 to 50 [] 50 to 100 [] 100 and above
[]

Q.14. How many meals do you manage per day? (Tick) One [] Two [] Three [] More
than three []

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

Appendix 9: Home Literacy Environment Questionnaire (HLEQ)

Dear Parent/Guardian,

You are being invited to participate in this study in which your child/dependent who is in Grade 7 atSchool has been selected as a participant. This study is for academic purposes only. Therefore, the information being gathered will not be availed to other people or institutions other than those concerned with this study. As a matter of priority, high confidentiality will be upheld throughout this research process and names of participants will remain anonymous. For this reason, you do not need to write your name(s) on this form.

I thank you in advance,

Respondent's Demographic Data

Age of respondent: Gender:

Relationship to the child:

Child ID #:

Respond to questions which apply to your situation by ticking or writing in the spaces provided. Understand each item carefully before to respond to it.

1. Primary Language

S/N	QUESTION	Chitonga	Ila	Nyanja	English	OTHERS (SPECIFY)
1	Which language do you speak?					
2	Which language does your Husband /Wife speak?					
3	Which language is used most frequently in your home?					
5	Which language does your child use when playing with others?					

6	Which language does your Maid/caregiver mainly use in your home?					
7	Which language do you use when talking to your child?					

2. How many children of school going age are in your home?

Of these children, how many are in the

- (a) Seventh grade?
 (b) Junior and Secondary grades?
 (c) Other grades?

3. 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 []

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

- Formal employment [] specify:
 Non formal employment [] specify:
 Other things [] specify:
 Nothing []

5. Are you able to read and write?

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

6. Do you have a general family library in your home? (Tick only one)

Yes [] No []

If no, justify your answer:

.....

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

Yes [] No []

If no, justify your answer:

.....

8. 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 []

9. If there is a children's library, where do you get the books from?

Schools [] Shops [] Other library [] Any other sources []

10. If there is a children's library, how are the books are 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 []

11. 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:

.....
.....

12. Do you read to your child/Children in your home? (Tick only one)

Usually [] Sometimes [] Never []

13. If you do read to your child/Children, when did you last read to him/her/them in the last seven days?

Once [] Twice [] three times [] More than three times []

14. Do you have a schedule/timetable to guide your reading sessions with your child/ren?

Yes [] No []

15. What type of reading activities do you engage your child/Children in? (tick as many as possible)

Letters of the alphabet [] syllables [] words [] sentences [] short stories []

16. Do you experience any challenges when reading to your child/Children? (tick only one)

Usually [] Sometimes [] Never []

Give examples of challenges you experience with reading

.....
.....

17. What type of writing activities do you engage your child/Children in? (Tick as many as possible)

Letters of the alphabet [] syllables [] words [] sentences [] short stories

18. 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

.....
.....

19. 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)

20. Do you experience any challenges in Maths with your Child/Children? (Tick only one)

Usually [] Sometimes [] Never []

Give examples of challenges you experience with Maths

.....
.....

21. Who mostly assists the child with school work at home?

Mother [] father [] siblings [] Neighbours [] Hired trained teacher []

Hired un-trained teacher [] No one [] **(tick only one)**

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

Library/study room [] Sitting room [] Dining room [] Bedroom []

Kitchen [] Outside [] School []

23. Do have a chalk board or white board at home for teaching your child/ren? (tick only one)

Yes [] No []

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

Usually [] Sometimes [] Never []

25. What sorts of academic incentives are mostly provided to child/ren? (tick only one)
(tick only one)

Verbal praises [] Tokens [] Written comments [] Stickers []
Family outings [] other []

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

Usually [] Sometimes [] Never []

27. Who assists you to educate and take care of your child/children?

Husband [] Wife [] others specify

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

Appendix 10: School Literacy Environment Checklist (SLEC)

Dear Head Teacher,

I am a Master student from the University of Zambia, currently conducting research entitled: *“The influence of Executive functioning on reading comprehension among grade seven Pupils in Itezhi-tezhi District, Zambia.”* You are invited to participate in this study in which your School has been randomly selected. Be assured that this study is for academic purposes only and therefore, the information gathered will not be availed to other people or institutions other than those concerned with this study. As a matter of priority, high level of confidentiality will be upheld throughout this research process and that names of participating Schools will remain anonymous. For this reason, you do not need to write your name(s) or that of your School on this form. 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.

I thank you in advance

School ID:

1. How many Pupils are in grade 7 at your school this year?

Boys:

Girls:

Total:

2. Do you have a class library in grade 7 classroom?

Yes [☐] No [☐]

3. If your answer is No, where do you keep books? (Tick what applies)

(a) Store room [☐]

(b) Head Teacher’s Office [☐]

(c) Deputy Head Teacher’s Office [☐]

(d) Senior Teacher’s Office [☐]

4. How many English text books, story books and other books are available for use by grade seven (7) Pupils in your School?

(a) English text books:

(b) Story books:

(c) Other books:

Total books available:

5. How do pupils access books for reading in your School? (Tick what applies)
- (a) Pupils ask for books from their teachers when they want to read/use []
 - (b) The school has a specific day in a week/month when all pupils are given books to read/use for a specific period []
 - (c) Books are only available to pupils during lessons []
6. Do you have school reading policy in your School?
- Yes [] No []
7. Does the School give incentives to pupils who are able to read and write?
- Yes [] No []
8. If yes, how often does your School award pupils who are able to read and write in a year?
- Weekly [] Monthly [] Termly []
9. Do you have a supervised prep at your School?
- Yes [] No []
10. If yes, how much time is spent on supervised prep in a week?
- 40 Minutes [] 80 Minutes [] 2 hours []

END: *Thank you very much for your cooperation.*

Appendix 11: Participant Information Sheet

Participant information sheet for Parents/Guardians of Children who have been selected in a research entitled “*The influence of executive functioning on reading comprehension among grade seven Pupils in selected Primary School in Itezhi-tezhi District, Zambia*”

- ❖ Participant information sheet is intended to share information about the study with you
 - ❖ Participants to retain a copy of this information sheet
-

Introduction

I am a Postgraduate student from the University of Zambia, conducting a research entitled “*The influence of executive functioning on reading comprehension among grade seven Pupils in selected Primary Schools in Itezhi-tezhi District, Zambia*” I am pleased to invite you and your grade seven child to be part of this study. However, you are not compelled to decide today whether or not to participate but given ample time to discuss with anyone you feel comfortable with about the study. Please feel free to ask me where you need clarity.

Purpose of the research

The purpose of this research is to assess the influence of executive functioning on reading comprehension among grade seven pupils at middle primary School level in six selected primary schools in Itezhi-tezhi District.

Research Requirements

This research will involve your participation by filling in two questionnaires. Your grade seven child will also be assessed by the researcher at school. The assessments are in inform of tests which target to examine executive function skills of your child. Your child will be required to provide both oral and written answers during the assessments. This will help the researcher to establish how executive functioning influences reading comprehension so that measures are put in place to improve reading comprehension skills in primary school.

Participant Selection

You are being invited to take part in this research because your grade seven child has been selected in this study. There is need for you as a parent/Guardian to provide information by rating behaviour exhibited by your child at home which is associated to specific domains of

executive function using behavioural Rating Inventory for Executive Function (BRIEF2) questionnaire which is an important requirement in this research. The search will be incomplete without your input.

Example of questions to elucidate understanding:

Do you know why we are asking you to take part in this study? Do you know what the study is about?

Voluntary Participation

Your participation in this research is entirely voluntary. It is your choice whether to participate or not. If you choose not to participate all the services, you and your child receive at the school will continue and nothing will change. The choice that you make will have no bearing on your job or school work of your child. You may change your mind later and stop participating even if you agreed earlier because it is your absolute right.

Examples of question to elucidate understanding:

If you decide not to take part in this research, do you know what your options are? Do you know that you do not have to take part in this research, if you do not wish to? Do you have any questions?

Procedures

A. You are invited together with your grade seven child to take part in this research. You need to provide information about your grade seven child who has been selected in his study to enable the researcher assess the influence of executive functioning on reading comprehension. If you accept to part of the study and allow your child as well, then you will be asked to fill in two questionnaires and your grade seven child will undergo assessment tests which requires both oral and written answers.

B. Kindly provide necessary information needed in his research. You will provide this information by filling in behavioural rating inventory for executive function questionnaire to get information about everyday behaviour associated with specific domains of executive function exhibited by your child at home. You will be required to indicate whether your child has exhibited the problem described by the 63 statements on Behavioural Rating Inventory for Executive Functions questionnaire over the past six months. You will circle letters against each statement as follows: circle letter **N**, if the behaviour is **never a problem**, circle letter **S**, if the

behaviour is **sometimes a problem** or letter **O**, if the behaviour is **often a problem**. It will take approximately 10 to 15 minutes to complete the form.

You will also be required to fill a Home Literacy Environment Questionnaire to get information of literacy levels of your home where your child stays. The Home Literacy Environment Questionnaire will address two aspects, namely: the home literacy and the home learning-support. The information obtained on the Home Literacy Environment Questionnaire will help to give an insight on Home-Literacy and Learning Support available where your child stays. It will take about 5 to 10 minutes to complete filling in the questionnaire. You will be invited to the school where your grade seven child is learning from to fill in the above stated questionnaires.

Duration

The research will take place for a period of three months. During this time, you will be invited to come to the School where your grade seven child is learning from and you will be required to fill in two questionnaires. Your child will undergo assessment tests once during this stated period and he/she will take approximately one hour to complete both oral and written assessment tests.

Examples of question to elucidate understanding: If you decide to take part in the study, do you know how much time is required to complete questionnaires? Do you know where you will be required to go and fill in questionnaires? If you agree to take part in the study and allow your child as well, do you know that you and your child can stop participating at any stage of the study and no consequences are expected? Do you know that you may not respond to the questions that you do not wish to respond to? Do you have any more questions?

Uses of information

The information we shall get from you will be used for academic purposes only and will help education stake holders to make decisions that might mitigate the low reading comprehension levels experienced by pupils in Zambian primary schools.

Risks

There are no risks that you and your child will be exposed to due to your participation in the research. Your safety is assured

Benefits

There will be no direct benefit to you, but your participation is likely to help find out more about the influence of executive functioning on reading comprehension among grade seven Pupils. Zambian curriculum developers may consider including executive function stimulating activities in the syllabus which in turn may improve reading comprehension skills among primary school Pupils in Zambia. The findings of this study may provide an insight on the influence of executive functioning on reading comprehension among seventh graders in schools and may give room for further research which may improve the quality of reading comprehension levels among primary school pupils.

Reimbursements

You will not be provided any incentive to take part in the research and no monetary benefits should be expected by participants. Participation is purely on voluntary basis.

Examples of question to elucidate understanding: Can you tell me if you have understood correctly the benefits that you will have if you take part in the study? Do you have any other questions?

Confidentiality

The research being done in the community may draw attention and if you participate you may be asked questions by other people in the community. We will not be sharing information about you to anyone outside of the research team. The information that we collect from this research project will be kept private. Any information about you will have a code on it instead of your name. Only the researchers will know what your code is and it will be locked up with a lock and key and It will not be shared or given to anyone.

Sharing the Results

Nothing that you tell the researcher today will be shared with anybody outside the research team, and nothing will be attributed to you or your Child by name. We shall uphold high levels of confidentiality. The research findings of this study will be shared with you and your community through publications.

Right to Refuse or Withdraw

Participation in this research is voluntary and no one will be forced to participate. Participants have the right to decide not to be part of his study. Participants who decide to be part of his study have the right to withdraw from the study anytime if they wish so and that will not attract consequences.

I will give you an opportunity at the end of filling questionnaires to review your remarks and you can ask to modify or remove portions of the information you have provided if you so wish.

Question to elucidate understanding: Do you know that you do not have to take part in this study if you do not wish to? You can say No if you wish to? Do you know that you can ask me questions later if you wish to? Do you know that I have given the contact details of the person who can give you more information about the study? You can ask me any more questions about any part of the research study, if you wish to. Do you have any questions?

Appendix 12: Informed Consent Form

Informed consent form for Parents/Guardians of Children who have been selected in a research entitled *“The influence of executive functioning on reading comprehension among grade seven Pupils in selected Primary School in Itezhi-tezhi District, Zambia”*

- ❖ Sign this Consent form if you choose to participate
 - ❖ Participants to retain a copy of informed consent form
-

I have been invited to participate in research entitled **“The influence of executive functioning on reading comprehension among grade seven Pupils in selected Primary School in Itezhi-tezhi District, Zambia”** I have read the foregoing information/it has been read to me. I have had the opportunity to ask questions about it and any questions I have asked have been answered to my satisfaction. I consent to voluntarily be a participant in this study. In this regard, I equally consent and allow my Child/dependent who is a grade seven pupil at (Name of School) Primary School to be a participant in this study.

Name of Participant _____

Signature of Participant _____

Date _____ (Day/month/year)

If illiterate

I have witnessed the accurate reading of the consent form to the potential participant, and the individual has had the opportunity to ask questions. I confirm that the individual has given consent freely.

Print name of witness _____

Thumb print of participant

Signature of witness _____

Date _____ (Day/month/year)

If vulnerable or incapacitated like pregnant women, children, people with mental illness, people with disabilities, prisoners and minority groups for instance, the investigator must ensure that there is a well-educated and motivated surrogate or proxy decision maker. When comprehension is an issue the research plan should include means of testing the participants' understanding of the important information prior to enrollment.

Statement by the researcher

I have accurately read out the information sheet to the potential participant, and to the best of my ability made sure that the participant understands. I confirm that the participant was given an opportunity to ask questions about the study, and all the questions asked by the participant have been answered correctly and to the best of my ability. I confirm that the individual has not been coerced into giving consent, and the consent has been given freely and voluntarily. I have provided a copy of this certificate of informed consent form to the participant.

Signature of Researcher: _____ **Date** _____
(Day/month/year)