

**ORTHOGRAPHIC KNOWLEDGE IN ISIXHOSA AND ITS RELATION TO
PHONOLOGICAL PROCESSING, LETTER-SOUND KNOWLEDGE,
READING AND SPELLING.**

A thesis submitted in fulfilment of the requirements for the degree of

MASTER OF ARTS of
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by

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DEDICATION

I dedicate this thesis to my late father, who taught me everything I know about hard work and determination, and whose voice saying “It’s all going to be worth it” got me through many difficult days while completing this thesis.

Thomas Lawrence Bennett (1960.05.15 – 2021.01.03)


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PLAGIARISM DECLARATION

I, Mikaela Ann Daries, hereby declare that this thesis is my own original work and has not, in its entirety or part, been submitted at any university for a degree.

Signed:  _____

Date: 4 September 2022

ABSTRACT

Despite international research confirming its importance, writing and related metalinguistic skills have often been neglected in comparison to reading in literacy research (Cunningham *et al.*, 2001; Castles & Coltheart, 2004; Nag, 2007; Roman *et al.*, 2009; Zhao *et al.*, 2017). On a national level there are very few studies that have explored the writing aspect of literacy in South Africa, and none that has investigated orthographic knowledge in a Southern Bantu language, such as isiXhosa. In an attempt to address this gap, this thesis explores orthographic knowledge and its components in isiXhosa. In particular, it seeks to investigate the unique predictors of word specific and general orthographic knowledge as well as their role for reading and spelling in isiXhosa while controlling for phonological awareness (PA), rapid automatized naming (RAN), and letter-sound knowledge. Furthermore, the thesis attempts to situate its findings within the main premises of the self-teaching hypothesis and dual route approach to orthographic processing in order to contribute to linguistic theories of reading with cross-linguistic evidence (Jorm & Share, 1983; Share & Jorm, 1987; Share, 1995; Grainger & Ziegler, 2011).

A quantitative cross-sectional study was conducted with 140 isiXhosa home language third grade learners in which word specific and general orthographic knowledge tasks were specifically designed. These tasks were administered along with oral reading fluency (ORF), spelling, PA, RAN, and letter-sound knowledge. The findings revealed that letter-sound knowledge and PA contributed the largest variance towards both word specific and general orthographic knowledge. Further, word specific orthographic knowledge and letter-sound knowledge were the only significant predictors of spelling. Similarly, both word specific and letter-sound knowledge were significant predictors of reading, along with RAN and general orthographic knowledge. Quantile linear regression analyses revealed that word specific orthographic knowledge was a robust predictor of spelling and letter-sound knowledge was a robust predictor of reading across ability levels confirming the importance for word specific orthographic knowledge for spelling and letter-sound knowledge for reading in isiXhosa. In relation to the two reading theories considered in this thesis, the findings reflect similarities between the assertions of the self-teaching hypothesis and current thesis with suggestions made for further inquiry. The dual route approach to orthographic processing provides insights into the potential processing of orthographic information while reading in isiXhosa. The findings of this study confirm the importance of orthographic knowledge for reading and spelling for languages with transparent orthographies such as isiXhosa.

TABLE OF CONTENTS

ACKNOWLEDGEMENTS	ii
PLAGIARISM DECLARATION.....	iii
ABSTRACT.....	iv
LIST OF TABLES	viii
LIST OF FIGURES	ix
LIST OF ACRONYMS	x
CHAPTER 1: INTRODUCTION.....	1
1.1 Background to research.....	1
1.2 Research questions.....	6
1.3 Brief overview of method	6
1.4 Major findings.....	7
1.5 Scope of thesis and future research recommendations	8
1.6 Structure of thesis	8
CHAPTER 2: LITERATURE REVIEW.....	10
2.1 Introduction.....	10
2.2 Orthography	10
2.2.1 Language structure of isiXhosa	12
2.2.2 History of isiXhosa orthography.....	14
2.3 Orthographic knowledge.....	16
2.3.1 Measuring orthographic knowledge	20
2.4 Relationship between orthographic knowledge and variables in thesis.....	23
2.4.1 Letter-sound knowledge and orthographic knowledge.....	23
2.4.2 Phonological awareness and orthographic knowledge	25
2.4.3. Rapid automatized naming and orthographic knowledge.....	27
2.4.4. Oral reading fluency and orthographic knowledge.....	29
2.4.5. Spelling and orthographic knowledge	31
2.5 Related theoretical theories of reading	33
2.5.1 Self-teaching hypothesis	33
2.5.2 The dual route approach to orthographic processing.....	36
2.6 Summary of literature review	41

CHAPTER 3: METHOD	43
3.1 Introduction.....	43
3.2 Ethical clearance and consent	44
3.3 Pilot phase.....	44
3.3.1 Introduction.....	44
3.3.2 Participants and schooling context.....	45
3.3.3 Orthographic knowledge tasks.....	45
3.3.3.1 Word specific orthographic knowledge	45
3.3.3.1.1 Task development	45
3.3.3.1.2 Task administration and scoring	50
3.3.3.2 General orthographic knowledge task	50
3.3.3.2.1 Task development	51
3.3.3.2.2 Task administration and scoring	53
3.3.4 Findings of pilot phase.....	53
3.4 Main data collection phase.....	55
3.4.1 Participants and schooling context.....	55
3.4.2 Measures	56
3.4.2.1 Word specific orthographic knowledge task.....	56
3.4.2.1.1 Task administration and scoring	56
3.4.2.2 General orthographic knowledge task	57
3.4.2.2.1 Task administration and scoring	58
3.4.2.3 Spelling task.....	58
3.4.2.3.1 Task development	58
3.4.2.3.2 Task administration and scoring	59
3.4.2.4 Oral reading fluency	60
3.4.2.5 Phonological awareness task.....	60
3.4.2.5.1 Task development	60
3.4.2.5.2 Task administration and scoring	61
3.4.2.6 Rapid automatized naming	63
3.4.2.7 Letter-sound knowledge.....	64
3.4.3 Procedures.....	65
3.4.4 Data coding and analysis	66

3.4.5 Conclusion	66
CHAPTER 4: RESULTS	68
4.1 Introduction.....	68
4.2 Overview of results	69
4.2.1 Orthographic knowledge.....	69
4.2.2 Rapid automatized naming	73
4.2.3 Phonological awareness	74
4.2.4 Oral reading fluency	75
4.2.5 Spelling	76
4.2.6 Letter-sound knowledge.....	77
4.3 Inferential statistics	77
4.3.1 Correlation matrix.....	77
4.3.2 Multiple general linear regressions	78
4.3.2.1 Predictors of word specific orthographic knowledge	81
4.3.2.2 Predictors of general orthographic knowledge	83
4.3.2.3 Predictors of reading	85
4.3.2.4 Predictors of spelling	89
CHAPTER 5: DISCUSSION	94
5.1 Introduction.....	94
5.2 What is the orthographic knowledge (word specific and general) of grade 3 isiXhosa home language learners?.....	94
5.3 What is the relationship between letter-sound knowledge, PA, RAN and word specific and general orthographic knowledge in grade 3 isiXhosa home language learners?	96
5.4 What are the unique contributions of orthographic knowledge (word specific and general), letter-sound knowledge, RAN and PA to reading and spelling of grade 3 isiXhosa home language learners? 101	
5.5 How can the findings from the above research questions be situated within the assertions of the self-teaching hypothesis and the dual route approach to orthographic processing?	106
5.5.1 Self-teaching hypothesis	106
5.5.2 Dual route approach to orthographic processing	108
CHAPTER 6: CONCLUSION.....	113
6.2.1. The measurement of orthographic knowledge in isiXhosa.....	114
6.2.2 Metalinguistic predictors of word specific and general orthographic knowledge	114

6.2.3 The role of word specific and general orthographic knowledge for reading and spelling....	115
6.2.4 The findings in relation to the self-teaching hypothesis and the dual route approach to orthographic processing.	115
6.2.4.1 Self-teaching hypothesis	115
6.2.4.2 Dual route approach to orthographic processing	116
6.3 Pedagogical implications	117
6.4 Closing remarks	117
REFERENCES.....	119
APPENDICES.....	137
1. IsiXhosa orthography-phonology correspondences (Diemer, 2015, pg.181-185).....	137
2. Consent form.....	141
3. Ethical clearance certificate	142
4. Word specific orthographic knowledge task marking sheet	143
5. General specific orthographic knowledge task marking sheet	144
6. Oral reading fluency passage	145
7. PA task marking sheet	146
8. RAN item and letter-naming tasks instruction and marking sheet	147
9. Letter-sound knowledge task marking sheet.....	148
10. Rmarkdown of data analysis	149

LIST OF TABLES

Table 1: Words per sentence in conjunctive and disjunctive writing systems	14
Table 2: Pilot phase word specific orthographic knowledge task.....	49
Table 3: Pilot phase general orthographic knowledge task	52
Table 4: Main data collection phase general orthographic knowledge task	57
Table 5: Spelling task.....	59
Table 6: Phonological awareness task	62
Table 7: Descriptives statistics (N=140).....	72
Table 8: Number and proportion of participants per ORF category	75
Table 9: Pearson's correlation matrix.....	80
Table 10: Multiple general linear regression – word specific orthographic knowledge predicted.....	82
Table 11: Multiple general linear regression - general orthographic knowledge predicted	84
Table 12: Multiple general linear regression – ORF predicted.....	86
Table 13: Quantile regression model predicting ORF at the 0.1, 0.5 and 0.9 quantiles	87
Table 14: Multiple general linear regression - spelling predicted	90
Table 15: Quantile regression model predicting spelling at the 0.1, 0.5 and 0.9 quantiles	92

LIST OF FIGURES

Figure 1: Orthographic knowledge components (adapted from Apel, 2011: 595)	19
Figure 2: Traditional Dual Route Model (Coltheart et al., 2001)	37
Figure 3: BIAM model (Grainger & Ferrand (1994) as cited in Grainger & Ziegler (2011:2)	37
Figure 4: Dual route model of orthographic processing (Grainger & Ziegler, 2011:3)	38
Figure 5: Adapted version of dual route model of orthographic processing	40
Figure 6: RAN letter-naming task.....	64
Figure 7: RAN item-naming task.....	64
Figure 8: Letter-sound knowledge task.....	65
Figure 9: Density plot- Word specific orthographic knowledge	70
Figure 10: Density plot - General orthographic knowledge	71
Figure 11: Density plot - Rapid automatized letter-naming (LCPS)	73
Figure 12: Density plot – Rapid automatized item-naming (ICPS).....	74
Figure 13: Density plot – Phonological awareness.....	74
Figure 14: Density plot - ORF (WCPM)	76
Figure 15: Density plot- Spelling.....	76
Figure 16: Density plot - Letter-sound knowledge (LCPM)	77
Figure 17: Diagnostic plots – predictors of word specific orthographic knowledge	81
Figure 18: Dot and whisker plot – predictors of word specific orthographic knowledge	82
Figure 19: Diagnostic plots- predictors of general orthographic knowledge	83
Figure 20: Dot and whisker plot – predictors of general orthographic knowledge	84
Figure 21: Diagnostic plots- predictors of reading	85
Figure 22: Dot and whisker plot – predictors of ORF	86
Figure 23: Dot and whisker plot - Quantile regression: predictors of ORF.....	88
Figure 24: Diagnostic plots- predictors of spelling.....	89
Figure 25: Dot and whisker plot – predictors of spelling	90
Figure 26: Dot and whisker plot - Quantile regression: predictors of spelling.....	93
Figure 27: Dual route model of orthographic processing (Grainger & Ziegler, 2011: 3)	109
Figure 28: Adapted version of dual route model of orthographic processing	110

LIST OF ACRONYMS

PA	Phonological Awareness
RAN	Rapid Automatized Naming
EGRS	Early Grade Reading Study
EGRA	Early Grade Reading Assessment
DBE	Department of Basic Education
ORF	Oral Reading fluency
LCPM	Letters correct per minute
WCPM	Words correct per minute
ICPS	Items correct per second
LCPS	Letters correct per second
PIRLS	Progress in International Reading Literacy Study
SACMEQ	Southern and Eastern African Consortium for Monitoring Educational Quality
ANA	Annual National Assessment

CHAPTER 1: INTRODUCTION

This chapter introduces the main investigation objectives of this thesis. As will be discussed in detail below, the study aims primarily to investigate the nature of orthographic knowledge in isiXhosa. In order to achieve this objective, I aim to establish the relationship between orthographic knowledge and other well established metalinguistics skills known to contribute towards literacy development (Hulme & Snowling, 2015). Therefore, this thesis examines the relationship between orthographic knowledge and letter-sound knowledge, phonological awareness (PA), rapid automatized naming (RAN), reading and spelling. Further, the findings will be analysed and interpreted in consideration of the assertions of the self-teaching hypothesis and the dual route approach to orthographic processing (Jorm & Share, 1983; Share & Jorm, 1987; Share, 1995; Grainger & Ziegler, 2011). The research interests of this study have yet to be explored in literacy research on Southern Bantu¹ languages, such as isiXhosa, and the findings of this study will therefore contribute to the growing body of research dedicated to deciphering the linguistic nuances of literacy in relation to Southern Bantu languages.

This introductory chapter will contextualise the study within the current literacy crisis in South Africa. In particular, it will highlight why orthographic knowledge is worth exploring as a literacy component which contributes to literacy ability in isiXhosa. Further, this section will outline the research questions that guide this thesis and foreshadow the research methods used. In addition, the scope of the thesis and recommendations for future research are discussed following a summarised presentation of the main findings of the research. Finally, an outline of the structure of the thesis will be presented.

1.1 Background to research

It is widely acknowledged that the majority of South African learners perform poorly across literacy assessments on both an international and national scale (Spaull, 2013; Howie *et al.*, 2017). The results of the Progress in International Reading Literacy Study (PIRLS) are often provided as the prime example of the country's literacy underachievement as reflected against international standards. The PIRLS assesses grade 4 reading comprehension at five-year intervals (Howie *et al.*, 2017). The results of the most recent PIRLS (2016), in which South Africa placed last, showed that 78% of grade 4 learners are unable to read for meaning, which is seen as the overall objective of successful reading.

¹ The term Bantu, as used in this thesis, is not politically driven and is not used to refer to people as occurred during the apartheid regime. The term is simply used as linguistic classification referring to the Bantu group within the Niger-Congo language family.

In particular, 88% of isiXhosa learners were unable to comprehend texts (Howie *et al.* 2017). These poor results are further reflected in national assessments. Spaul's (2013: 3) report found that South African learners are not able to read, write, and comprehend for their appropriate grade and age, with the majority of learners described as "functionally illiterate". This is supported by the results of the 2007 Southern and Eastern African Consortium for Monitoring Educational Quality (SACMEQ) for South Africa. SACMEQ is an association of ministries of education located in the Southern Africa sub-region (Series, 2015). These ministries primarily undertake educational policy research with the main aim of creating reliable information that can be used to improve the quality of education in the Southern Africa sub-region (Series, 2015). The results from their 2007 analysis of literacy in South Africa declared that 27% of grade 6 South African learners were illiterate, which was assessed by reading and comprehension tasks (Spaul, 2013). Further, results from South Africa's 2012 Annual National Assessment (ANA) revealed an average of 47% for grade 3 literacy in the Eastern Cape and a national average of 51% (Spaul, 2013).

More recent results from literacy interventions, such as the Early Grade Reading Study 2 (DBE, 2017), a South African Department of Basic Education collaboration aimed at providing large scale randomised control trial interventions and evaluations assessing real and nonword recall, phonemic awareness, letter-sound knowledge, word recognition, listening comprehension, sentence reading, and vocabulary, found that despite one year of intervention, 45.7% of learners could not read a single word in one minute in their home language (e.g. isiZulu or Siswati; Schaefer & Kotze, 2019). In addition, results from the Early Grade Reading Assessment (EGRA) done with Northern Sotho, Xitsonga and isiZulu grade 3 learners revealed the following proportions of learners who could not read a single word correctly on the ORF task in the respective languages: 17.7%, 19.81% and 20.44% (Spaul *et al.*, 2020). The EGRA is an orally administered diagnostic assessment for reading that measures a number of foundational literacy skills, for example, letter-sound knowledge and ORF (DBE, 2021).

These results evidence the aptly described literacy crisis prevalent in South Africa. The situation has been further exacerbated by the Covid-19 pandemic which has led to partial and complete school closures in 2020 and 2021. The school closures have been disproportionately longer in developing countries than in high income countries, with schools in developing countries lacking the infrastructure to support successful remote learning (Ardington *et al.*, 2021). Learners' prolonged absence from school is likely to further aggravate the already alarming literacy statistics in South Africa. More than 70% of South African schools are no-fee schools, and learners from these schools had in 2020 only learnt approximately 25-50% of what they normally would have learnt in previous years (Spaul *et al.*,

2021). Thus, researchers who intend to examine the longitudinal impact of Covid-19 on literacy performance in South Africa could refer to the results of this thesis as an example of literacy performance during Covid-19 times.

Large scale literacy assessments such as the PIRLS, ANA and SACMEQ provide invaluable results which indicate literacy levels in South Africa. However, from a psycholinguistic perspective, large scale assessments, such as those listed above, often fail to reveal the underlying linguistic components which have contributed to learners' poor results, and further how our understanding of this can inform intervention and evaluation, leading to better performing learners.

Spaull *et al.* (2020) have noted that there is a prioritization of larger-scale assessments of comprehension in South Africa, which tends to present only the top of a complex comprehension iceberg. They suggest that beneath the comprehension iceberg exists a wealth of skills which contribute to overall comprehension and that this should be investigated fully to appreciate the results of large scale assessments done with African languages². Consequently, there has recently been an increase in literacy assessments done in South Africa that measure more than comprehension and reading fluency, for example, the EGRS and EGRA, as well as a growing body of research dedicated to exploring the linguistic constructs that underpin reading in isiXhosa (Mpiti, 2012; Diemer, 2015; Diemer *et al.*, 2015; Probert, 2016; Probert & de Vos, 2016; Rees, 2016; Daries & Probert, 2020; Daries *et al.*, in press; Schaefer *et al.*, 2020).

It is worth noting that there are a number of macro factors that contribute to South Africa's literacy crisis. These factors include: poverty, lack of resources in schools, poorly trained teachers, overcrowded classrooms, low adult literacy levels, family backgrounds, and the poor implementation of the current language in education policy (Pretorius & Mokhwesana, 2009; Spaull *et al.*, 2020). These issues are extensively discussed in Pretorius and Mokhwesana (2009) and Spaull *et al.* (2020), but fall beyond the scope of this thesis.

Diemer *et al.* (2015) assert that linguists and literacy scholars have the opportunity to play a crucial role in emphasising the importance of detailed linguistic study of the factors contributing to our country's literacy crisis. This argument is summarized by Spaull *et al.* (2020), in which they state that a substantial empirical basis is necessary to obtain valuable insights about early reading development

² In this thesis, the term African languages is used to refer to the official South African languages other than English and Afrikaans.

in African languages, and, furthermore, to understand how best to reduce literacy inequalities within South Africa's education system. In light of this, I have chosen to focus on the linguistic skills that underpin literacy in isiXhosa in order to contribute to the literature aimed at providing empirical psycholinguistic evidence from South Africa to promote the mitigation of the country's literacy crisis.

As mentioned previously, the body of research dedicated to understanding African language literacy is growing, but there is still much to be explored. This was illustrated in Pretorius's (2018) annotated bibliography which brought to light the limited research available on reading in African languages. In particular, there were only 17 studies featured in the bibliography which focused on Nguni languages³. Further, while there has been growth in research relating to the microlinguistic factors in African languages, this research has tended to focus on aspects of phonological awareness (PA) or the transfer of specific literacy skills (Schaefer *et al.*, 2020; Makaure 2021; Wilsenach 2013, 2019).

The focus on phonological processes may be a result of the fact that Nguni languages generally, and isiXhosa in particular, are rooted in oral traditions, meaning oral language and related skills are more prominent. Further, isiXhosa's transparent orthography has meant that researchers tend to focus on the phonological aspects of the language as research has attested to the importance of PA in languages with transparent orthographies, including isiXhosa (Lekgoko & Winskel, 2008; Melby-Lervåg *et al.*, 2012; Malda *et al.*, 2014; Pretorius, 2015; Probert, 2019; Schaefer & Kotzé, 2019).

Consequently, less focus has been given to the written language and the skills related to and underpinning writing such as orthographic knowledge. Orthographic knowledge is defined as the information stored in our memory that informs individuals on how to represent spoken language in written forms correctly (Apel, 2011). Orthographic knowledge and its components, namely, word specific and general orthographic knowledge are expanded on in greater detail in [Chapter 2 section 2.3](#).

Apel (2011) points to a large barrier for researchers who are exploring orthographic skills. That is, for approximately the last 50 years, language has been described in reference to its components: phonology, morphology, syntax, semantics, and pragmatics. It is worth noting that orthography and related skills are rarely considered as part of this list of language components. Apel (2011) reasons that this omission may result from the fact that researchers have primarily thought about spoken language when discussing language components, seemingly implying the greater importance of

³ The Nguni languages are a branch of the Southern Bantu language family inclusive of isiXhosa, isiZulu, SiSwati and isiNdebele.

reading. This may also be because it is understood that spoken language precedes written language, and thus we can't have written language without spoken language. However, it is important to consider these skills as inherently interrelated as the spoken and written form are both essential for advancement in modern society. In recognition of this, the definition of language needs to be more inclusive of the written component of language, and further research should reflect this inclusivity. Thus, it is the endeavour of this study to recognize the crucial role of orthographic knowledge for literacy.

To my knowledge, there are currently no studies on orthographic knowledge in the Southern Bantu languages. Therefore, studies that focus on orthographic knowledge in Southern Bantu languages are needed. International research which has been done mainly on English confirms that orthographic knowledge is related to and contributes to literacy skills (Cunningham *et al.*, 2001; Castles & Coltheart, 2004; Apel *et al.*, 2006; Nag, 2007; Roman *et al.*, 2009; Zhao *et al.*, 2017). Thus, the motivation to investigate orthographic knowledge in isiXhosa is justified.

In addition, the relationship of orthographic knowledge to other well-known literacy skills (letter-sound knowledge, PA and RAN) will be considered and the contribution of orthographic knowledge to vital literacy outcomes (reading and spelling) will also be examined. The above-mentioned skills are discussed in greater detail in [Chapter 2 section 2.4](#). The relationship between the literacy skills mentioned above and orthographic knowledge have yet to be examined in the Southern Bantu languages. However, research has attested to the important role of letter-sound knowledge, PA, and RAN for literacy development in Southern Bantu languages (Diemer, 2015; Schaefer & Kotze, 2019; Schaefer *et al.*, 2020) and reading and spelling are recognized as important literacy outcomes necessary for successful involvement in modern society (Zarić *et al.*, 2020).

Furthermore, this thesis considers two theories of reading for data interpretation. Firstly, the self-teaching hypothesis proposed by Jorm & Share (1983; 1987; Share, 1995) which states that phonological skills perform a 'self-teaching' function enabling children to acquire word specific orthographic representations (Cunningham, 2006). Secondly, the dual-route approach to orthographic processing that proposes the existence of two distinct sub-lexical orthographic routes which provides a comprehensive account of orthographic processing when reading (Grainger & Ziegler, 2011). Since the majority of current reading theories are based on reading in English, it is hoped that the interpretation of the above-mentioned theories in relation to isiXhosa literacy findings will allow for valuable cross-linguistic contributions to be made to largely Euro-centric linguistic theories. These two theories will be discussed in greater detail in [Chapter 2 section 2.5](#).

The findings of this study will contribute to the literature by filling in the gaps in our understanding of orthographic knowledge in isiXhosa, its relationship to letter-sound knowledge, PA, RAN, reading, and spelling, as well as contribute to relevant linguistic theory. The potential significant pedagogical implications which may originate from the findings of this thesis provide further motivation for this investigation.

1.2 Research questions

The research questions which will be answered in this study are presented below:

1. What is the orthographic knowledge (word specific and general) of grade 3 isiXhosa home language learners?
- 2 a. What is the relationship between letter-sound knowledge, RAN (item and letter-naming), PA and word specific orthographic knowledge in grade 3 isiXhosa home language learners?
b. What is the relationship between letter-sound knowledge, RAN (item and letter-naming), PA and general orthographic knowledge in grade 3 isiXhosa home language learners?
- 3 a. What are the unique contributions of orthographic knowledge (word specific and general), letter-sound knowledge, RAN (item and letter-naming) and PA to reading in grade 3 isiXhosa home language learners?
b. What are the unique contributions of orthographic knowledge (word specific and general), letter-sound knowledge, RAN (item and letter-naming) and PA to spelling in grade 3 isiXhosa home language learners?
4. How can the findings from the above research questions be situated within the assertions of the self-teaching hypothesis and the dual route approach of orthographic processing?

1.3 Brief overview of method

This thesis followed a cross-sectional, correlational, quantitative research design. Overall there were 140 grade 3 participants selected from five schools in Kwanobuhle in the Eastern Cape, with 53% boys and 47% girls. The average age was 8.42 years old. The variables of interest in this study are word specific and general orthographic knowledge, PA, RAN, letter-sound knowledge, ORF and spelling. Thus, these were the skills measured in the study. Currently, there are no standardized literacy tasks for isiXhosa. Thus, the orthographic knowledge tasks were specifically designed for the study and piloted before main data collection.. The spelling task was taken from Davies and Probert (2020) with minor adaptations made. The PA, RAN, and letter-sound knowledge tasks were taken from the EGRA

for isiXhosa learners (DBE, 2021). However, the PA task was further adapted for use in the current study. The ORF task was taken from the Story Powered Schools Project and EGRS 2 (DBE, 2017).

Trained research assistants who are isiXhosa home language speakers administered all tasks with the learners. The administration of the tasks was overseen by myself and all testing was done in isiXhosa. All tasks, except the spelling task which was group administered, were conducted on a one-to-one basis between the research assistant and the learner. Furthermore, the data was analysed statistically using R version 4.04 (2021).

1.4 Major findings

The word specific orthographic knowledge task developed for this study was found to be considerably reliable and therefore provides a strong basis for the development of tasks of orthographic knowledge that can be used in other studies on Southern Bantu languages. Letter-sound knowledge and PA were found to be dominant predictors of both word specific and general orthographic knowledge with RAN letter-naming also found to be predictive of word specific orthographic knowledge. This indicates that there might be differences in the development of word specific and general orthographic knowledge in isiXhosa.

Both word specific and general orthographic knowledge were found to contribute significantly to the learners' reading ability along with letter-sound knowledge and RAN item and letter-naming. Further, letter-sound knowledge was discovered to be a robust predictor of reading for this sample of grade 3 isiXhosa learners. Word specific orthographic knowledge and letter-sound knowledge predicted spelling with word specific orthographic knowledge identified as a robust predictor of spelling. This thesis provides evidence for the importance of letter-sound knowledge for reading and spelling in isiXhosa as it predicted the most variance for both reading and spelling.

In addition, the findings provide support for the main premises of the self-teaching hypothesis (Jorm & Share, 1983; Share & Jorm, 1987; Share, 1995). However, they also provide evidence for the need for deeper investigation of the self-teaching hypothesis in its explanation of the PA, word specific orthographic knowledge and reading relationship in isiXhosa. The thesis also supports the dual approach to orthographic processing as it presents preliminary evidence for the potential use of both the coarse-grained orthographic code and the fine-grained orthographic code when reading in isiXhosa with learners using the coarse-grained code to a slightly greater degree.

The findings of this thesis not only add to the growing body of literature on the linguistic nuances of African language literacy but also provide a further foundation for the exploration of orthographic knowledge in isiXhosa.

1.5 Scope of thesis and future research recommendations

This thesis includes a cross sectional study and thus provides findings from one-time measurement. The thesis would be strengthened by longitudinal research with a larger sample which investigates the developmental and casual relationships between the variables in this thesis. Researchers could also look at other grade levels other than grade 3 learners, which was the focus of this thesis. Whilst the language of interest in this thesis is isiXhosa, future researchers are encouraged to consider language transfer effects as learners are inevitably exposed to other languages within their school or home. For example, English is a curriculum subject in all South African schools.

Eight variables were considered in this thesis. These were word specific orthographic knowledge, general orthographic knowledge, PA, RAN item-naming, RAN letter-naming, letter-sound knowledge, reading and spelling. Future research can extend this list to consider other variables for investigation, for example, morphological awareness and syntactic awareness. Orthographic knowledge was the priority of these eight variables and thus tasks of orthographic knowledge were specially designed for this thesis. The development of these tasks emphasized reliability; however, future research needs to consider both the reliability and validity of these tasks.

1.6 Structure of thesis

The thesis is divided into five chapters. The above introductory chapter ([Chapter 1](#)) has provided an overview of the context of this thesis and has laid the foundation for the direction of the remainder of the thesis.

In [Chapter 2](#), the literature review, literature relevant to the current study is discussed in order to further contextualize the research. Orthography in general, and then specifically in relation to isiXhosa, is discussed first to provide a basis for the discussion of orthographic knowledge. Second, a detailed discussion of orthographic knowledge is provided followed by sections which discuss the relationship between orthographic knowledge and letter-sound knowledge, PA, RAN, reading and spelling. Lastly, the chapter discusses the two main theories of reading used for data interpretation in the present study.

[Chapter 3](#), the method, describes the development of the measures used in this study. As there are currently no studies or standardised tests which have looked at orthographic knowledge in isiXhosa, the orthographic knowledge tasks used were specifically created for the current study. Thus, this chapter discusses in detail the key decisions made in the development of the orthographic knowledge tasks. A pilot study was conducted to assess the reliability of these tasks and the results of this pilot study are presented in this chapter. The development and procedures used for the letter-sound knowledge, PA, RAN, ORF and spelling tasks are also presented in this chapter.

[Chapter 4](#) provides the results of the study. An overview of the results for each of the eight measures in the study are presented first. This is followed by the inferential statistical analyses which includes a correlation matrix to assess the strength and direction of the relationships between the variables of interest and multiple general linear regressions to examine the predictive nature of these relationships. In particular, the role of letter-sound knowledge, PA and RAN for word specific and general orthographic knowledge and the contribution of the above-mentioned variables to reading and spelling respectively. Lastly, quantile linear regressions are presented to further interrogate the role of word specific and general orthographic knowledge, letter-sound knowledge, PA and RAN at different ability levels (0.1, 0.5 and 0.9 quantiles) of reading and spelling proficiency respectively.

[Chapter 5](#), the discussion, provides an in-depth discussion of the main findings in succession of the research questions of this thesis. In each section of this chapter, an explanation of the significance of the findings and their relevance to related literature is included along with suggestions for further research.

Lastly, [Chapter 6](#) concludes the thesis by providing a summary of its main findings and the pedagogical implications thereof.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

This chapter will provide the theoretical context related to orthographic knowledge and the research objectives of the thesis. As orthographic knowledge relies inherently on the existence of an orthography, this chapter begins with exploring orthography ([section 2.2](#)). It provides a brief overview of what orthography is and how it is classified. This is followed by an explanation of the orthographic and linguistic properties of isiXhosa ([section 2.2.1](#)). Thereafter, a brief history of the historical and socio-linguistic factors linked to the creation of the isiXhosa orthography is explained ([section 2.2.2](#)). Following this, a detailed account of orthographic knowledge is presented ([section 2.3](#)), inclusive of how it is measured ([section 2.3.1](#)), and how orthographic knowledge has been found to be related to the additional metalinguistic variables of interest in this thesis (letter-sound knowledge, PA, and RAN) and the outcome variables (spelling and reading) ([section 2.4](#)). Lastly, a detailed discussion of the reading theories of focus in the study is presented ([section 2.5](#)).

2.2 Orthography

An orthography is the complex visual representation of oral language (Schroeder, 2010). There are a multitude of intertwining components and processes that shape an orthography, including phonology, morphology, and cognitive processes involved in the decoding and encoding of print as well as historical and sociolinguistic factors which influence an orthography's creation. As orthographic knowledge is inherently linked to orthography, it is necessary that it is discussed prior to that of orthographic knowledge.

Schroeder (2010: 2) defines orthography as consisting of two parts: firstly, the symbols that represent the orthography, such as graphemes, characters, diacritics, and punctuation marks (Seifart, 2006). For example, an alphabet is often used by modern languages to represent sounds in languages, and languages that utilize an alphabet are known as alphabetic languages. In languages that have an alphabetic orthography, like English and isiXhosa, grapheme(s) are assigned to distinctive sounds (Seifart, 2006). In addition, there are logographic orthographies, in which characters represent morphemes, for example, Chinese (Mandarin and Cantonese) (Seifart, 2006). There are also syllabaries and abjads. Syllabaries, such as Japanese Kana, also utilize an alphabet, but instead of assigning a grapheme to each sound, it is assigned to the syllables in languages (Seifart, 2006). Abjads orthographies assign a glyph to each consonant in the orthography with vowel quality left unspecified in the orthography, for example, Arabic and Hebrew (Daniels, 1996).

The second part of Schroeder's (2010: 2) definition reflects on the writing rules of the orthography. This relates to the rules and conventions used in the language; for example, punctuation rules, written word boundary rules, and orthographic rules which may be influenced by phonology or morphology (Siefert, 2006; Schroeder, 2010). Thus, orthographies reflect the connection between the symbols used to represent sounds of the language and the rules which regulate how they are used in the orthography. The linguistic and orthographic characteristics of isiXhosa are further discussed in the following section.

As isiXhosa is the language of focus in the present study, it is worth noting further features of an alphabetic orthography. Alphabetic orthographies are described along a continuum of orthographic depth between being transparent and opaque (Caravolas, 2004). In transparent orthographies, the relationship between graphemes and phonemes is relatively consistent with mostly regular one-to-one mappings (Spaull et al., 2020). For example, in isiXhosa, the words *umama* (English: mother) and *amanzi* (English: water) are said exactly the way they are written, illustrating the regular letter-sound correspondences in the language. Contrastively, in more opaque orthographies such as English, letter-sound relationships are often not as consistent with a number of irregularities (Spaull et al., 2020). For example, the sound /k/ can be represented by multiple different graphemes, for example <ck> in *kick*, /c/ in *cat* and /k/ in *kite*, making the letter-sound relationships less regular than in transparent orthographies.

Cross-linguistic research has argued that a language's orthographic consistency in relation to its letter-sound correspondences has an impact on learner's literacy development (Aro & Wimmer, 2003; Caravolas, 2006; Ellis et al., 2004; Seymour et al., 2003 as cited in Georgiou et al., 2012). For example, it has been argued that children learning in languages with transparent orthographies ought to learn letter-sound relationships relatively faster than children learning in opaque orthographies, which would in turn fast track literacy acquisition for beginner readers (Miller et al., 2012). However, this argument does not take into consideration other language specific factors that may influence the pace of literacy acquisition; for example, isiXhosa has a large inventory of letter-sound correspondences, some of which are inclusive of complex graphemes and consonant blends, that may also affect literacy acquisition (Diemer et al., 2015).

2.2.1 Language structure of isiXhosa

This section outlines the orthographic properties of isiXhosa, as well as additional linguistic properties of the language.

IsiXhosa (S41) is a Southern Bantu language and belongs to the Nguni language group that is inclusive of isiXhosa, isiZulu, isiNdebele, and SiSwati (Guthrie, 2017). As is the case with all Southern Bantu languages, isiXhosa is an agglutinating language (Spaull *et al.*, 2020). Characteristic of agglutinating languages is their rich morphological structure which includes the extensive use of affixation on nominal and verbal roots, with verbal forms being particularly complex (Gxilishe *et al.*, 2009). Verbal roots in agglutinative languages allow for up to nine positions for morphemes to be attached; for example, subject and object marking, tense, negation, causative and applicative (Gxilishe *et al.*, 2009). This is seen in Example 1 below.

Example 1:

Umama uyahlalisa umntwana phansi [isiXhosa; Orthographic representation]

U-mama u-ya-hlal-is-a um-ntwana phansi

NC1-mother SM1-PRES-sit-CAUS-FV NC1-child down

‘Mother is making the child sit down’

**NC- noun class SM- subject marker PRES-present tense CAUS - causative FV- final vowel*

As mentioned above, isiXhosa has an alphabetic orthography, therefore, phonemes in the language are represented by graphemes (letters). In isiXhosa there are five vowel sounds represented by letters *a, e, i, o, u*. Some of these letters can be doubled to represent vowel length as a result of morphological and phonological changes, for example, *oomama* (English: mothers) vs. *umama* (English: mother) and *intombi* (English: girl) vs. *iintombi* (English: girls) (Diemer, 2015). There are also 77 consonant phonemes, and, since there are only 21 letters of the alphabet used in isiXhosa, there are many sounds in isiXhosa that are represented by orthographically complex letter groups as compensation (Doke, 1954; Saul, 2013). For example, complex graphemes and consonant blends in which multiple letters correspond to a single sound, for example, <tsh>, <ng>, <ph>, <kh>, <kw>. This results in a large inventory of letter-sound correspondences and the presence of complex graphemes can make words substantially longer and denser in isiXhosa. Consequently, this impacts the pace of decoding (Diemer, 2015). An overview of the orthography-phonology correspondences for isiXhosa can be found in [Appendix 1](#).

African languages make the further distinction between conjunctive and disjunctive writing systems (Spaull *et al.*, 2020). IsiXhosa, like many Nguni languages, has a conjunctive writing system (Spaull *et al.*, 2020). In conjunctive writing systems, the orthography directly reflects the agglutinative character of the language; for example, verbal forms in sentences are usually written together as single orthographic words (Louwrens & Poulos, 2016; Spaull *et al.*, 2020) as shown in Example 2 below.

Example 2:

Bayadanisa

[isiXhosa; Orthographic representation]

Ba-ya-danis-a

SM2-DISJ-dance-FV

‘They are dancing’

**NC- noun class SM- subject marker DISJ-disjoint marker FV- final vowel*

Sesotho languages generally have a disjunctive writing system, where verbs, copulatives, qualificatives, and adverbs are generally written disjunctively resulting in more ‘orthographic words’ (Louwrens & Poulos, 2016; Spaull *et al.* 2020). This is illustrated in Example 3 below that presents the same sentence as seen in Example 2, but in Sesotho. As Sesotho is still an agglutinative language, there are still some conjunctive elements evident, especially for verbal forms that contain complex morphological features, for example, affixation on the verbal root (Louwrens & Poulos, 2016).

Example 3:

Ba a tantsha

[Sesotho; Orthographic representation]

Ba a tantsh-a

SM2 DISJ dance-FV

‘They are dancing’

**NC- noun class SM- subject marker DISJ-disjoint marker FV- final vowel*

Conjunctive writing systems typically contain longer words resulting in dense texts with very few monosyllabic words (Spaull *et al.*, 2010). This results in longer texts with few short words (Spaull *et al.*, 2020) as seen Table 1 below which illustrates the difference in word lengths across conjunctive and disjunctive writing systems. For isiZulu, which has a conjunctive writing system, there are an average of 3.6 words per sentence; however, for Northern Sotho, which has a disjunctive writing system, there are an average of 11 words per sentence. In addition, isiXhosa has an open syllable system resulting in a regular CV (consonant-vowel) structure. This distinction between conjunctively and disjunctively written writing systems can affect learners reading acquisition, because it introduces

additional orthographic complexity as learners are faced with the challenge of unpacking what a ‘word’ is in these languages, with words being much longer in conjunctively written writing systems (Probert, 2019).

Table 1: Words per sentence in conjunctive and disjunctive writing systems (Source: Spaull *et al.* 2020: 4)

Language	Text
Northern Sotho (Sepedi)	Ka le lengwe la matsatsi mosepedi yo a bego a na le tlala. O fihlile motseng wo mongwe a kgopela dijo. Go be go se na yo a bego a na le dijo.
Xitsonga	Siku rin’wana mufambi loyi a ri na ndlala. U fikile emugangeni. A kombela swakudya, kambe a ku nga ri na loyi.
isiZulu	Kunesihambi esasilambile kakhulu. Sahamba sicela ukudla emizini yabantu. Abantu babe ngenakho ukudla.
Translation	There was a stranger who was very hungry. He came to a village and asked for food. Nobody had any food.

Additional orthographic conventions of isiXhosa include: the capitalization of proper nominal forms, and not noun class markers, for example, *uMphathiswa wezeMumdo* (English: Minister of Education) (Jones *et al.*, 2005); the use of apostrophes to indicate vowel elision, for example, *ind’enkul’iyatsha* (English: the big house is burning): and the use of borrowed forms which are typically incorporated into the morphological structure of isiXhosa, but can sometimes result in unusual letter combinations when not incorporated correctly, for example, *ikhompyutha* instead of *ikhompiyutha* (English: computer) (Jones *et al.*, 2005). The <py> letter combination is an unusual form in the standard form of isiXhosa. These conventions add an additional layer onto the orthographic information learners need to pay attention to when reading and absorb for use when writing. Therefore, it seems rational to assume that this will affect learners’ orthographic knowledge acquisition as they are required to digest an abundance of phonological and orthographic information. To date, there are no comprehensive studies on the reading acquisition of isiXhosa learners which examines how both the phonological and orthographic load of isiXhosa affects language learning. This is an area highlighted for future research.

2.2.2 History of isiXhosa orthography

The orthography of isiXhosa has a colonial origin that is worthy of discussing in order to grasp the influences that impacted upon its creation. However, this discussion will be brief as a detailed discussion of the history of the creation of the isiXhosa orthography, and the debates around this, are beyond the scope of this thesis. Rather, this section provides a brief snippet of the history of the

isiXhosa orthography in order to provide background on the language and its orthography as basis for the further discussion of orthographic knowledge.

British missionaries have been credited with the introduction of the first written texts in isiXhosa which were first captured in the late 18th century (Maseko, 2017). The interests of missionary work, stemming from Christian communities in Europe of the time, led to the written forms of isiXhosa as we know them today (Maseko, 2017). John Bennie, a Scottish missionary who worked in South Africa, is widely recognized as the pioneer of written isiXhosa, with his first printed isiXhosa words appearing in 1823 (Maseko, 2017). The process of converting this largely oral language to written form was accompanied by a grammatical description of the language with fixed rules presumed to have derived from the structural features of European languages, particularly that of Latin and English, (Louwrens & Poulos, 2016; Maseko, 2017).

From a historical perspective, it is argued that the creation of the written form was born in an era of African colonization with the initiative of early missionaries only possible if they could communicate effectively with the colonized (Van Wyk, 1987). According to Kosch (1993), there is a European influence that can be evidenced on Bantu languages' word boundaries. For example, Setswana is supposedly influenced by English word boundaries resulting in the disjunctive nature of Setswana (Louwrens & Poulos, 2016). However, linguistic evidence has shown that the orthographies of African languages are mainly influenced by the phonological features of the languages (Louwrens & Poulos, 2016).

From a linguistic perspective, the primary distinction between conjunctive and disjunctive writing systems is made on the basis of aligning the linguistic properties of the language with its orthography (Louwrens & Poulos, 2016). For example, vowel coalescence and vowel gliding would be impractical to accommodate in a disjunctive orthography (Land, 2015), and thus isiXhosa primarily has a conjunctive orthography due the presence of vowel coalescence in the language. This is demonstrated in Example 4 below taken from Probert and De Vos (2016). In Example 4, the two vowels 'a' and 'u' coalesce to create 'o', indicating a disjunctive orthography would not be suited as it would contradict the phonetic pronunciation.

Example 4:

Utata na umama → realised as: *utata nomama* [isiXhosa; Orthographic representation]

U-tata na u-mama → *u-tata no-mama*

NC1- father CONJ NC1-mother → NC1-father CONJ-NC1.mama

‘Mother and father’

*NC- noun class CONJ - conjunction

There remains many inconsistencies and anomalies with regard to the standardization of the modern isiXhosa orthography that require attention (Saul, 2013; Jones *et al.*, 2005, Maseko, 2017). For example, Saul (2013) provides an analysis of the existing standardised orthographical system of isiXhosa, in particular the weaknesses in its representation and possible ways to address these weaknesses. He notes the following main weaknesses presented in standardised isiXhosa literary texts, press reports, government publications, and educational materials: the lack of orthographic consistency, in particular, the misrepresentation of aspirated sounds as ejections, for example, *thatha* (English: take) vs *tata* (English: father) which can lead to the misinterpretation of meaning (Saul, 2013). Further, the lack or misuse of capitalisation, errors in word division related to the conjunctive character of isiXhosa, and inconsistencies in the spelling of loan words. He explains that these discrepancies, along with others mentioned in the thesis, are not conducive for effective written communication in isiXhosa (Saul, 2013). However, whether these discrepancies are systematic enough to undermine the consistency of the letter-sound relationships in the language has yet to be explored and is posed as question for future inquiry.

There is still much uncertainty surrounding the orthography of isiXhosa with regard to both its origin and structural makeup which should be acknowledged when attempting to study its features and related skills, such as those explored in the current study.

2.3 Orthographic knowledge

Orthographic knowledge is defined as the information stored in our memory that informs individuals on how to represent spoken language in written form correctly (Apel, 2011; Conrad *et al.*, 2013). This is informed by an understanding of the written conventions of the particular language orthography. In particular, Apel (2011) highlights that there is significant variation in the definition and use of the term orthographic knowledge and related concepts such as orthographic awareness and orthographic processing. This creates a challenge for the interpretation of findings relating to orthographic related skills. Additional research is necessary to determine the nuances of orthographic knowledge and

related concepts in different languages to reach a clearer understanding of orthographic knowledge. However, Apel (2011) attempts to clarify much of the confusion related to the definition of these terms which are worth mentioning before describing orthographic knowledge.

Orthographic processing is the universal term that describes the ability to acquire, store, and use both word specific and general orthographic knowledge (Apel, 2011). This means that orthographic knowledge is closely linked to orthographic processing (Loveall *et al.*, 2013), but orthographic knowledge seems to include the practical use of orthographic processing when reading and writing in a language. Orthographic awareness describes an individual's implicit or explicit awareness of orthographic knowledge (Apel, 2011). The definition provided refers to a meta-construct in which there is both an unconscious and conscious consideration of orthographic features. However, researchers often use tests of orthographic knowledge to assess orthographic awareness, and these terms are therefore sometimes used interchangeably (Manis *et al.*, 2000; Burt, 2006; Kirby *et al.*, 2008 as cited in Apel, 2011). Further research is needed to investigate whether there are nuances which distinguishes these terms from one another, or whether they are synonymous; this is, however, beyond the scope of this thesis. For the purposes of this thesis, orthographic knowledge will be used as its definition describes most aptly the orthographic knowledge tasks measured in this thesis. What is meant by this, is that the learners are using their practical knowledge to manipulate and reflect on the orthographic representations of the stimuli in order to complete the tasks, and thus it is mostly a conscious application of orthographic knowledge as opposed to an awareness of the orthographic information as described by orthographic awareness.

In recent studies on orthographic knowledge, researchers have considered orthographic knowledge as a multi-dimensional skill consisting of two main components: word specific orthographic knowledge and general orthographic knowledge (Apel, 2011; Conrad *et al.*, 2013; Loveall *et al.*, 2013; Rothe *et al.*, 2015; Zarić *et al.*, 2020).

Word specific orthographic knowledge refers to one's mental representations of specific words and their parts as well as their phonological representations (Apel, 2011). Further, word specific orthographic knowledge comprises the specific sequences of graphemes which represent written words (Apel, 2011). This knowledge requires the mapping of printed words onto single and specific word names, and this often becomes an automatic skill (Loveall *et al.*, 2013). A number of cross-linguistic studies attest to the role of word specific orthographic knowledge for reading and spelling (Greek: Georgiou *et al.*, 2008b; Persian: Arab-Moghaddam & Senechal, 2001; Dutch: Bekebrede *et al.*, 2009;

English: Conrad *et al.*, 2013; Cunningham & Stanovich, 1990; Deacon *et al.*, 2012; German: Zarić *et al.*, 2020). Findings with transparent orthographies, such as Dutch, Persian, and German, indicate that word specific orthographic knowledge contributes greater towards spelling than reading (Arab-Moghaddam & Senechal, 2001; Bekebrede *et al.*, 2009; Zarić *et al.*, 2020) suggesting that this may also be the case for isiXhosa which is also transparently written.

General orthographic knowledge describes the understanding of orthographic patterns that govern how speech must be represented in a particular orthography (Apel, 2011). This knowledge is not word specific. Examples of governing orthographic rules include: knowledge of how speech sounds may be represented by a letter or letters, inclusive of the alphabetic principle; restrictions on letter combinations, for example, the letters <jr> together is not a legal letter combination in English and isiXhosa; and the rules which govern the positions in which letters cannot be used, i.e., orthotactics (Apel, 2011). For example, in isiXhosa, the grapheme <ng> cannot occur in the coda or word final position. There are differential findings related to the contribution of general orthographic knowledge for reading and spelling in English. Conrad *et al.* (2013) found that general orthographic knowledge contributes similar variance for reading and spelling. Contrary to this, Ise *et al.* (2012) illustrate that general orthographic knowledge correlates significantly with spelling, but not reading. For German learners, Rothe *et al.*'s (2015) study revealed that general orthographic knowledge predicted significant variance to both reading and spelling. However, Zarić *et al.* (2020) highlight a number of limitations of the study conducted by Rothe *et al.* (2015), namely, issues with task development resulting in ceiling effects. In their study, Zarić *et al.* (2020) found that general orthographic knowledge significantly predicts both reading and spelling in German. Based on the findings of these studies, it can be hypothesized that both word specific and general orthographic knowledge will be significant predictors of both reading and spelling in isiXhosa.

Word specific and general orthographic knowledge are rationalized to contribute to reading and spelling in the following ways: word specific orthographic knowledge aids learners in being able to identify and produce words which in turn helps them to read and spell (Ehri, 2014; Zarić *et al.*, 2020), and when learners encounter a word with little recognizable lexical information they will utilize general orthographic knowledge in order to read or spell the word (Apel, 2011; Ehri, 2014, 2005).

It is important to note that most of the research that exists about the role of word specific and general orthographic knowledge for literacy is based on languages with opaque orthographies (e.g. English and French; e.g., Cunningham & Stanovich, 1990; Pacton *et al.*, 2001; Pacton & Fayol, 2004; Deacon

et al., 2012; Conrad *et al.*, 2013). To date, there are only a handful of studies that have considered their role in languages with transparent orthographies (e.g. German, Dutch, and Persian; e.g., Arab-Moghaddam & Senechal, 2001; Bekebrede *et al.*, 2009; Rothe *et al.*, 2015, Zarić *et al.*, 2020), which identifies a gap in the literature addressed by this thesis, and an area for further research.

Figure 1 below, adapted from Apel (2011), provides a visual illustration of the components of orthographic knowledge along with a brief description of each component:

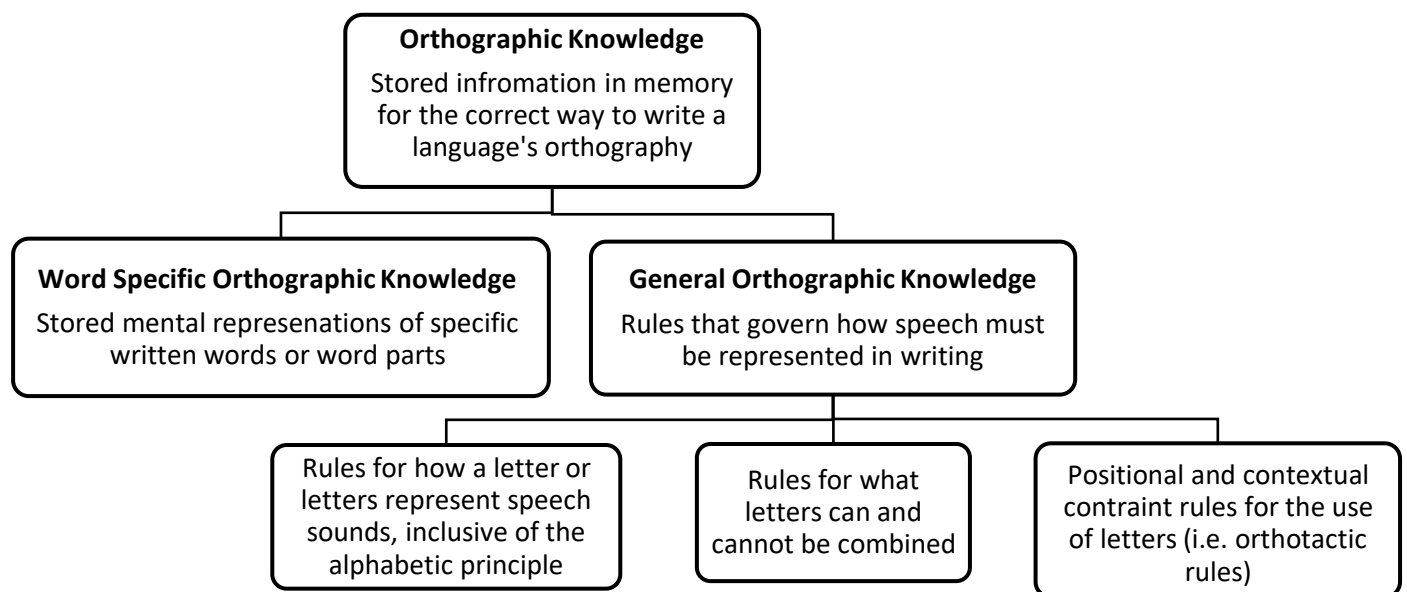


Figure 1: Orthographic knowledge components (adapted from Apel, 2011: 595)

In terms of the development of orthographic knowledge, there is a general consensus that it is acquired mainly by way of frequent exposure to print materials (Stanovich & West, 1989; Barker *et al.*, 1992; Berninger, 1994; Fletcher-Flinn & Thompson, 2004). However, the differential development of word specific and general orthographic knowledge is far less clear. Accurate word recognition necessitates an understanding of how letters combine in a language to form specific words (Apel 2011; Loveall *et al.*, 2013), suggesting that letter-sound knowledge is needed for the development of orthographic knowledge. Researchers have also found that young children demonstrate letter-sound knowledge and initial spelling abilities in kindergarten (Treiman & Broderick, 1998; Shatil *et al.*, 2000; Treiman & Kessler, 2004; Bara *et al.*, 2007), suggesting that orthographic knowledge also develops quite early as

it is considered to be an underlying skill for spelling, and is linked to the development of letter-sound knowledge (Templeton & Morris, 2000).

Additional observations about the development of orthographic knowledge include the fact that children seem to develop an understanding of the orthographic representations of consonant sounds before the representation of vowel sounds (Ehri, 1986; Stage & Wagner, 1992). It has been suggested that general orthographic knowledge develops before word specific orthographic knowledge (Cassar & Treiman, 1997; Burt, 2006; Wolter & Apel, 2010; Apel, 2011). Research related to the distinction between word specific and general orthographic knowledge development is both limited and inconsistent, and while it is not within the scope of the current thesis, more research is needed investigating the cross-linguistic longitudinal development of orthographic knowledge. In particular, whether one of these skills develops before the other or whether one predicts the progression of the other in children's reading and spelling development (Loveall *et al.*, 2013).

2.3.1 Measuring orthographic knowledge

While there are some inconsistencies in the exact use of the measure, the most commonly used measure for orthographic knowledge has been the orthographic choice task (e.g., Olson *et al.*, 1994; Conrad, 2008; Ricketts *et al.*, 2008; Sears *et al.*, 2008; Papadopoulos *et al.*, 2009; Tong *et al.*, 2009 as cited in Apel, 2011; Loveall *et al.*, 2013). The common practice when conducting this task has been to ask participants to make a judgment between two written words, in which they need to choose the word that represents a real word in the language (Apel, 2011). Usually, the pair of written words would include one real word and a second phonetically similar and orthographically dissimilar word which would be the incorrectly spelled form of the first word, referred to as a pseudohomophone, for example *train* and *trane* (Apel, 2011). This type of task requires the language to have both a variety of homophonic or rhyming sounds and a variety of short and non-complex words which are easy to parse for the assessment of children's orthographic knowledge. The presence of homophonic words in isiXhosa are rare and monosyllabic non-complex words is not a common characteristic of isiXhosa, making the use of this task in its current form difficult to use in isiXhosa. Thus, in the current study, a task of word specific orthographic knowledge was developed for appropriate use in isiXhosa with some consideration of the task design elements discussed above.

Variations of the word specific orthographic knowledge task include those used by Berninger and colleagues (Berninger *et al.*, 1991; Berninger *et al.*, 1994; Berninger *et al.*, 2008; Berninger *et al.*, 2010), where individuals were shown a variety of nonwords and later tested for their recall,

recognition, and spelling of these newly learned words. This task differs from the traditional orthographic choice task in that the task assesses recently learned words stored in short term memory, as opposed to previously stored words in long term memory (Apel, 2011). Despite the variation in the measurement of word specific orthographic knowledge, there is a general consensus that orthographic choice tasks of any kind assess an individual's store of word specific orthographic representations (Apel, 2011).

In assessing general orthographic knowledge, tasks typically measure participants' awareness of permissible letter patterns and orthographic patterns used in the language (e.g., Cassar & Trieman, 1997; Cunningham *et al.*, 2001; Levy *et al.*, 2006; Verhoeven *et al.*, 2006; Georgiou *et al.*, 2009; Apel *et al.*, 2010 as cited in Apel, 2011). A commonly used task is the letter string choice task (Trieman, 1993; Cassar & Trieman 1997; Cunningham *et al.*, 2001). The task is fairly similar to the orthographic choice task in that participants are once again asked to make a judgement between a pair of words, however, instead of a real word and a pseudohomophone, two pseudowords are provided. The aim of the task is for the participant to choose the word which most represents a real word in the language, in that it conforms to the orthographic patterns which characterize the language; for example, choosing *wilk* instead of *wilv* in English (Apel, 2011). The use of pseudowords means that learners cannot rely on word specific knowledge, ensuring that individuals will have to use their knowledge of orthographic patterns (Apel, 2011). As the task does not seem to have any language specific demands, it should be applicable cross-linguistically. However, as will be discussed in [Chapter 3](#), the use of only two options per stimuli can create an issue of guessing answers which can affect the validity of the results. The letter-string choice task was adapted for use in isiXhosa in this thesis.

Alternative ways of testing general orthographic knowledge include asking learners to identify whether written words should contain a vowel or not, for example, *gow* instead of *ghw*, and whether they should contain numbers or not, for example, *koubt* instead of *ko6bt*, as used by Levy *et al.* (2006) and Ouelette and Senechal (2008a; 2008b). Another way of testing learners' word specific and general orthographic knowledge is through the analysis of spelling errors as done by Masterson *et al.* (2006), and Masterson and Apel (2010a, 2010b). In these studies, learners spelling errors were analysed in line with various linguistic categories, for example, orthographically allowable representations, orthographically unallowable, omission etc., to disseminate the underlying linguistic knowledge of the participants.

These assessments of word specific and general orthographic knowledge have been conducted predominantly with English individuals, with a growing number of studies which have conducted tasks of orthographic knowledge task across languages (e.g., Japanese: Bowers *et al.*, 1998; Spanish: Deacon

et al., 2013; German: Zarić *et al.*, 2020; Greek: Georgiou *et al.*, 2008b; Persian: Arab-Moghaddam & Senechal, 2001; Dutch: Bekebrede *et al.*, 2009). However, this has never been done with an African language. The word specific and general orthographic knowledge tasks used in this thesis consider the linguistic structure of isiXhosa while acknowledging as far as possible the task design of the studies mentioned above. This is discussed in greater detail in [Chapter 3](#).

As mentioned previously, research done mainly with English has shown that orthographic knowledge plays an important role in literacy development (Cunningham *et al.*, 2001; Castles & Coltheart, 2004; Apel *et al.*, 2006; Nag, 2007; Roman *et al.*, 2009; Zhao *et al.*, 2017). Further, we know that linguistic constructs of literacy work hand in hand. As such, individuals' reading and spelling ability can provide an indication of their orthographic knowledge (Apel, 2011). For example, as noted in Apel (2011), word reading tasks can provide an indication of learners' knowledge of word specific orthographic knowledge, and decoding tasks often require learners to employ their knowledge of orthographic patterns (general orthographic knowledge) along with phonemic skills. As one would assume, spelling tasks can assess individuals' knowledge of both word specific and general orthographic knowledge along with other metalinguistic skills (Apel, 2011). The interaction between linguistic constructs can present difficulties for task design. In particular, Berninger (1995) notes that when studying orthographic knowledge, it is impossible to create pure measures of orthographic knowledge that do not also assess phonological processing to some degree.

Adding to the latter argument regarding the interaction between different metalinguistic skills, the following section discusses the relationship between orthographic knowledge and the metalinguistic skills of interest in this thesis, namely, letter-sound knowledge, PA, and RAN, as well as the outcome variables reading and spelling. As previously noted, research attests to the influential role of letter-sound knowledge, PA, and RAN for literacy development in Southern Bantu languages (Diemer, 2015; Schaefer & Kotze, 2019; Schaefer *et al.*, 2020, amongst others) and reading and spelling are recognized as vital literacy outcomes (Zarić *et al.*, 2020). These metalinguistic variables are included to control for the variance they potentially explain when examining the contribution of word specific and general orthographic knowledge to reading and spelling as well as to assess their contribution to word specific and general orthographic knowledge.

2.4 Relationship between orthographic knowledge and variables in thesis

2.4.1 Letter-sound knowledge and orthographic knowledge

Letter-sound knowledge refers to the ability to accurately assign a sound(s) to its/their corresponding letter form (Huang *et al.*, 2014). This skill forms part of alphabet knowledge, which is the knowledge of names and sounds linked to the letters of the alphabet (McBride-Chang, 1999).

Letter-sound knowledge has been found to contribute to children's early literacy in alphabetic languages in a number of ways. Specifically, it aids in children's grasping of the alphabetic principle, which is the understanding that spoken language consists of discrete sounds that map onto letters in the alphabet which represent these sounds systematically (Huang *et al.*, 2014). Knowledge of the alphabetic principle is an early literacy landmark necessary for subsequent development (Lieberman *et al.*, 1990). Additionally, letter-sound knowledge has been shown to be a necessary precursor for decoding ability, another key building block of literacy (Huang *et al.*, 2014).

Learners need to have a strong letter-sound knowledge basis in order for them to grasp complex spellings such as consonant blends (Huang *et al.*, 2014). The more systematic the relationships are between the letters and sounds within a language, the easier it will be to master letter-sound knowledge in that language (Treiman *et al.*, 1998; McBride-Chang, 1999; Evans *et al.*, 2006; Justice *et al.*, 2006; Scanlon *et al.*, 2010; Huang & Invernizzi, 2012).

The literature converges on the importance of letter-sound knowledge for reading in both transparent and opaque orthographies (Share *et al.*, 1984; Bruck *et al.*, 1997; Gallagher *et al.*, 2000; Kirby *et al.*, 2003; Torppa *et al.*, 2006; Leppänen, *et al.*, 2008; Manolitsis *et al.*, 2009; Georgiou *et al.*, 2012). In fact, Landerl *et al.* (2021:113) states that knowledge of the graphic symbols of a language is seen as the "sine-qua-non of reading acquisition" for languages with varying orthographies. They do, however, acknowledge that the individual writing systems of languages should be considered. Research has found that those learners who do not master letter-sound knowledge during early literacy are at risk of falling behind in their education trajectory for both reading and writing (Treiman *et al.*, 1998; Storch & Whitehurst, 2002; Hammill, 2004; Landerl *et al.*, 2021).

The importance of letter-sound knowledge for orthographic knowledge is far less established. As mentioned previously, spelling can provide an indication of learner's orthographic knowledge (Templeton & Morris, 2000), and this is evidenced by a number of studies which have indicated that

orthographic knowledge significantly predicted spelling ability in languages with opaque or transparent orthographies (Arab-Moghaddam & Senechal, 2001; Bekebrede *et al.*, 2009; Ise *et al.*, 2012; Conrad *et al.*, 2013; Zarić *et al.*, 2020). Thus, to establish the link between letter-sound knowledge and orthographic knowledge, we refer mainly to research which has looked at the relationship between spelling and letter-sound knowledge. Studies are divided on whether the same literacy skills underlie reading and spelling across languages, with an insufficient number of cross-linguistic studies that have cross-examined the linguistic predictors of spelling (Caravolas *et al.*, 2001; Caravolas *et al.*, 2005; Smythe *et al.*, 2008; Furnes & Samuelsson, 2009).

Caravolas (2006) explains that depending on the degree to which languages conform to the alphabetic principle, individuals using these orthographies should rely on the same literacy building blocks, especially for alphabetic languages. Thus, this logic implies that letter-sound knowledge should predict spelling across languages which use the alphabetic principle. Evidence for this relationship is illustrated in Caravolas *et al.*'s (2003) longitudinal study which examined the role of letter-sound knowledge, PA, and IQ for reading and spelling in English and French. The study illustrated how letter knowledge is a significant predictor of spelling for both English and French.

The rationale that letter-sound knowledge is important for spelling is positively presumed, especially considering that spelling requires a conversion of speech to text which demands a well-established knowledge of the mapping of letters and sounds in a language. Further, Georgiou *et al.*'s (2012) longitudinal study of the predictors of reading and spelling in English, Greek, and Finnish, languages that vary in orthographic consistency, showed that letter-sound knowledge was the most predictive of subsequent reading and spelling across all three languages when PA and rapid automatized naming were also considered. As Finnish has a transparent orthography similar to isiXhosa, it can be hypothesized that letter-sound knowledge is likely to also be a significant predictor of reading and spelling and potentially orthographic knowledge in isiXhosa.

Georgiou *et al.* (2012) assert that these findings have significant implications for the teaching of both reading and spelling across languages. Firstly, they encourage educators to include letter-sound knowledge as an integral skill that needs to be included in assessments aimed at identifying learners at risk of spelling and reading challenges across languages (Georgiou *et al.*, 2012). Secondly, greater emphasis needs to be placed on providing learners with letter-sound knowledge intervention and training, especially for those experiencing difficulties with reading and spelling during early years of education. This is of particular importance for languages with transparent orthographies as the

mappings between graphemes and sounds is consistent and unambiguous (Schneider *et al.*, 2000; Van Otterloo *et al.*, 2009; Georgiou *et al.*, 2012).

If we consider the definitions of word specific and general orthographic knowledge, we can find evidence for the likelihood of a significant relationship between these variables and letter-sound knowledge. For example, word specific orthographic knowledge requires the mapping of printed words onto single and specific word names (Loveall *et al.*, 2013). One can imagine that learners would need to have letter-sound knowledge to facilitate the accurate mapping of print graphemes to word names. General orthographic knowledge is inclusive of the alphabetic principle (Apel, 2011), which, as noted above, is strongly linked to letter-sound knowledge. This indicates that general orthographic knowledge development would also necessitate letter-sound knowledge development. This study aims to establish whether this is indeed the case in isiXhosa.

2.4.2 Phonological awareness and orthographic knowledge

Phonological awareness (PA) is a multicomponent skill (Alcock *et al.*, 2018) that describes the understanding that spoken language can be broken up into sequences of sounds which can be further segmented and manipulated (Anthony *et al.*, 2003; Pretorius & Mokhwesana, 2009). Typically, PA consists of three components: phoneme awareness, onset-rime awareness, and syllable awareness (Castles & Coltheart, 2004). Each awareness can be assessed through tasks involving identification, segmenting, insertion, deletion, and substitution. In recent studies, researchers have tested at least two of the components of PA to calculate a composite PA score. In African language literacy studies, these skills are usually phoneme and syllable awareness. Onset and rime are not assessed in African language studies because of the few consonant clusters in onsets and the small number of closed syllables in isiXhosa. Across languages, research has shown that the developmental progression of PA usually follows that children acquire an awareness of larger phonemic units such as syllables before smaller units such as phonemes (Wilsenach, 2019; Goikoetxea, 2005; Share & Blum, 2005; Ziegler & Goswami, 2005; Diemer, 2015).

There is a consensus arising from the literature that PA significantly predicts reading and spelling across languages (Adams, 1990; Bryant *et al.*, 1990; Caravolas *et al.*, 2005; Babayiğit & Stainthorp, 2007; Landerl & Wimmer, 2008; Hulme & Snowling, 2015; Zarić *et al.*, 2020). Research with Southern Bantu languages has shown a similar trend with regards to a relationship between PA and reading (Pretorius & Mokhwesana, 2009; Malda *et al.*, 2014; Diemer *et al.*, 2015; Probert, 2019; Wilsenach, 2019) with growing research attesting to the relationship between spelling and PA for

African languages (Veii, 2003; Soares De Sousa *et al.*, 2010; Diemer, 2015; Nghikembua, 2020; Makuare, 2021).

The relationship between PA and orthographic knowledge is far less understood. Much of the international research on the relationship between PA and orthographic knowledge is interlinked with studies that focus on the premise of the self-teaching hypothesis which is explored in greater detail in [section 2.5.1](#). Briefly, the hypothesis states that the development of word specific orthographic knowledge is largely dependent on phonological processing abilities with multiple studies supporting a strong relationship between these variables (Stanovich & West, 1989; Share, 1995; Ehri, 1997; Share, 1999).

Loveall *et al.* (2013) examined the relation of phonological recoding and alphanumeric and non-alphanumeric RAN to both word specific and general orthographic knowledge. Hierarchical regressions were used to determine the relationship between these variables. The results showed that after controlling for IQ, phonological recoding explained 15% of the variance in word specific orthographic knowledge and marginally accounted for 9% of the variance in general orthographic knowledge. While this relationship was not wholly expanded upon by Loveall *et al.* (2013), and phonological recoding was assessed and not PA, their findings point to a relationship between phonological skill and word specific and general orthographic knowledge. Further research is required which investigates the specific relationship between word specific and general orthographic knowledge and phonological skills.

As already noted, spelling can be considered as a consolidated form of orthographic knowledge, and, as noted previously in this section, PA has been identified as an important contributor to spelling in international research (Bruck & Treiman, 1990; Treiman, 1993; Vellutino *et al.*, 2004) and for African languages (Veii, 2003; Diemer, 2015; Daries, 2019; Nghikembua, 2020; Soares De Sousa *et al.*, 2010; Makuare, 2021; Daries *et al.*, in press).

Diemer's (2015) study noted that spelling is directly related to phonological representations, but that it is also influenced by grammatical knowledge. She found that PA predicted 50% of the variance in spelling in a small sample of isiXhosa grade 3 learners. Further, Daries (2019) showed a strong and significant relationship between spelling and PA in isiXhosa with linear regression results showing that PA accounted for 59% of the variance in spelling. Daries *et al.*' (in press) conducted a conceptual replication study which expanded on the above mentioned research and found that PA was a robust predictor of spelling. In addition, Veii' (2003) cross sectional study looked at the reading and spelling

of grade 2-5 Herero/English bilinguals. The study found that PA reliably predicted spelling in Herero. Similar results were found in Nghikembua (2020) for Oshikwanyama foundation phase learners, Diemer (2015) with grade 3 isiXhosa learners and in a longitudinal study with foundation phase Northern-Sotho bilinguals in Makaure (2021).

These findings indicate a strong likelihood of a relationship between orthographic knowledge and PA in isiXhosa. However, additional research, such as that addressed in this thesis, is required which looks at the direct relationship between PA and word specific and general orthographic knowledge.

2.4.3. Rapid automatized naming and orthographic knowledge

Rapid Automatized Naming (RAN) describes the ability to name random sequences of either objects, colours, letters, or digits as fast as possible or in a set time (Kirby *et al.*, 2010). RAN tasks are often divided into two types: alphanumeric RAN (letters and/or digits) and non-alphanumeric RAN (objects and/or colours). In the present study, both alphanumeric RAN (letters) and non-alphanumeric RAN (objects) are assessed.

Cross-sectional and longitudinal studies demonstrate that RAN is a significant correlate of reading in a number of alphabetic languages, with varying degrees of transparency (English: Compton, 2003; Kirby *et al.*, 2003; Parrila *et al.*, 2004; Stainthorp *et al.*, 2013; Powell & Atkinson, 2021; Finnish: Lepola *et al.*, 2005; Georgiou *et al.*, 2008a; Caravolas *et al.*, 2013; Northern Sotho: Makaure, 2016, 2021 ; Dutch: de Jong & ven der Leij, 2003; Vaessen *et al.*, 2010;). This was also shown with isiXhosa in Schaefer *et al* (2020).

Research has shown that non-alphanumeric RAN is associated with early literacy skills (Bear & Baronee, 1991; Braisby & Dockrell, 1999). The development of alphanumeric RAN is said only to develop once learners have sufficient exposure and understanding of letters and numbers in language, and thus it is said to correlate to later reading development, for example, grade 1 and upwards (Meyer *et al.*, 1998; Compton, 2003; Lervåg & Hulme, 2009).

While RAN has been found to be necessary for reading development in a number of studies, the cognitive processes that drive this relationship are not fully understood and are still subject of debate (e.g., Scarborough & Domgaard, 1998; Kirby *et al.*, 2003; Näärhi *et al.*, 2005 as cited in Georgiou *et al.*, 2008a; Araújo *et al.*, 2015; Lervåg & Hulme, 2009; Poulsen *et al.*, 2015). An in-depth investigation

of the nature of the differing explanations of these processes is beyond the research objectives of the present thesis, but they should nevertheless be briefly acknowledged.

For example, some theories suggest that RAN taps into a part of the brain that deals with access to, and retrieval of, phonological information stored in our long-term memory (e.g., Wagner & Torgesen, 1987; Torgesen *et al.*, 1997). Thus, for children learning in transparent orthographies who need to decode by employing grapheme-to-phoneme conversion rules, RAN should be more important for reading as the rapid retrieval of phonological information is necessary for the effective conversion of graphemes to phonemes (Georgiou *et al.*, 2012).

Others have suggested that RAN is linked to reading through its relationship to orthographic processing, stating that children with poor RAN are not as sensitive to orthographic patterns (Bowers *et al.*, 1999; Bowers & Wolf, 1993). Therefore, for children reading in opaque orthographies, who need to decode by identifying chunks of letter-strings in words as opposed to individual graphemes, RAN would seemingly be important as learners need a strong foundation of orthographic processing in order for them to develop effective ‘chunking’ strategies (Georgiou *et al.*, 2012). Therefore, RAN is linked to reading as it helps with the establishment of a foundation in orthographic processing (Georgiou *et al.*, 2012). This is supported by the views of Barker *et al.* (1992), who suggests that the relationship between RAN and reading is likely to be mediated by orthographic knowledge as opposed to phonological skill.

With regards to the relationship between RAN and spelling, Georgiou *et al.* (2012) argue that if we were to pursue the logic of Bowers and Wolf (1993), who argue that orthographic representations are indexed by RAN ability, then the implication would be that RAN is linked to spelling due to the strong relationship between orthographic representation and spelling. They state that this relationship would be most prevalent for spelling in opaque orthographies where there is more of a reliance on orthographic patterning than phonological retrieval due to the inconsistent relationships between graphemes and phonemes. Conversely, RAN could also be important for spelling in transparent orthographies because RAN would facilitate the rapid access to phonological information which would in turn allow for the creation of quality orthographic representations needed for spelling (Wolf & Bowers, 1999; Georgiou *et al.*, 2012).

However, the literature does not always coincide with this rationale, with some recent cross-sectional studies having illustrated that RAN is not linked to spelling in languages with mostly consistent grapheme to phoneme mappings (e.g., German: Landerl & Wimmer, 2008; Greek: Nikolopoulos *et*

al., 2006; Turkish: Babayigıt & Stainthorp, 2010 as cited in Georgiou *et al.*, 2012). Conversely, Symythe *et al.* (2008) observed influential effects of RAN on spelling in English (inconsistent orthography) and Hungarian (consistent orthography). Georgiou *et al.* (2012) also found that RAN had a unique predictive variance in spelling in English (inconsistent orthography) and Greek (consistent orthography). Nevertheless, there are a number of studies attest to the relationship between RAN and spelling and writing (Berninger, 1996; Savage *et al.*, 2008; Stainthorp *et al.*, 2013).

The few studies that have looked at the relationship between RAN and orthographic knowledge have shown that they are interlinked (Bear & Baronne, 1991; Torgesen *et al.*, 1997; Denckla & Cutting, 1999; Manis *et al.*, 1999; Manis *et al.*, 2000; Sunseth & Bowers, 2002; Georgiou *et al.*, 2008a; Loveall *et al.*, 2013).

For example, Georgiou *et al.*'s (2008a) longitudinal study of the role of RAN and its components to reading fluency as well as its relationship to measures of phonological awareness, orthographic knowledge, and speed of processing showed concurrent correlations between orthographic knowledge and RAN components that tended to increase in time for English grade 2 and 3 learners. Manis *et al.*'s (2000) study of the relationship between measures of RAN, phonological awareness, orthographic skill, and other readings subskills in grade 2 English learners showed that alphanumeric (letters) and non-alphanumeric (digits) RAN correlated with word specific and general orthographic knowledge with r ranging from 0.3 – 0.64. However, Loveall *et al.* (2013) found that alphanumeric and non-alphanumeric RAN contributed differently towards word specific and general orthographic knowledge with alphanumeric RAN linked more closely to word specific orthographic knowledge, whereas non-alphanumeric RAN showed a greater association to general orthographic knowledge.

Based on the above, it can be tentatively suggested that RAN is a probable predictor of orthographic knowledge. However, greater research on the relationship between RAN and orthographic knowledge in transparently written languages would strengthen this predication. Further, although there is a growing body of research on RAN and its relationship to reading and spelling, (Stainthorp *et al.*, 2013; Araújo *et al.*, 2015; Powell & Atkinson, 2021; Landerl *et al.*, 2022) more research on languages other than English is needed to further interrogate this relationship, especially for African languages.

2.4.4. Oral reading fluency and orthographic knowledge

While there are a multitude of linguistic skills that underlie reading ability, and that can therefore be assessed as a measurement of learners' componential reading ability, for example, word recognition,

silent reading, and oral reading fluency (ORF), ORF is seen as an overall indicator of reading ability (Adams, 1990; National Reading Panel, 2000; Cummings & Petcher, 2016). For this reason, ORF will be used as the measure of reading in this thesis. ORF is defined as the ability to read a text quickly, accurately, and with meaningful expression, with the learner's voice expressing the prosody and intonation of spoken language (Draper & Spaul, 2015; Pretorius & Spaul, 2016).

Typically, participants are given a reading passage to read aloud within one minute, with the number of reading errors subtracted from the total number of words read in the one minute, which provides a WCPM (words correct per minute) score (Spaul *et al.*, 2020). ORF is understood as a bridge to reading comprehension (Pretorius & Spaul, 2016), as the speed at which print is read aloud has been identified as a major component of reading proficiency, and, with this, learners use less of their processing capacity and are able to absorb the meaning of a text (Draper & Spaul, 2015). Challenges in ORF can have a significant impact on the learning ability of children (Draper & Spaul, 2015).

The literature converges on the importance of PA, RAN, and letter-sound correspondence knowledge for reading development (Hulme & Snowling, 2015; Wagner and Torgesen 1987; Landerl *et al.*, 2022). Ellis and Large (1988) state that during the early stages of reading, there is a fairly undifferentiated blend of knowledge of the written characteristics of the letters of the alphabet along with short-term working memory processes. As learners progress, they develop a more multifaceted reading ability which builds on their already established knowledge but begins to rely more on phonological skill, letter-sound knowledge skills for the analysis of these visual patterns, and syntactic skills (Ellis & Large, 1988).

The role of vocabulary and morphological awareness have also been identified as influential for reading development, but are said to be applicable for development in proficient readers (Hulme & Snowling, 2015). Nevertheless, it can be agreed that reading is a complex process that necessitates the integration of numerous metalinguistic skills. For example, for word reading alone, readers need to be able to process phonological, morphological, syntactic, semantic, and orthographic information (Wagner & Torgesen, 1987; Chard *et al.*, 2000; Carlisle, 2003; Aro, 2004; Bolger *et al.*, 2005; Kirby *et al.*, 2010).

As noted above, longitudinal research that explores the role of these predictors for literacy development in the Southern Bantu languages is sparse and extended research is needed in this area. Makaure (2021) is one of the first studies to look at the longitudinal relationships between

phonological processing abilities and reading and spelling in Northern Sotho children. Her study found that PA (phoneme awareness in particular) was significant predictor of both reading and spelling.

The role of orthographic knowledge for reading has not been explored in African languages, thus much of what we know about their relationship is based on English. For example, Lovell *et al.* (2013) assert that the skilful use of orthographic knowledge can enable reading fluency, and, as a consequence, can enhance reading comprehension in English learners. Further, Adams (1990) states that reading fluency is aided by the accessing of well-established word specific orthographic representations. Cunningham *et al.*'s (2001) study with 62 English children showed that orthographic skill, measured by both word specific and general orthographic tasks, was significantly correlated to word recognition, with r ranging from 0.45 – 0.68, and that it significantly predicted 16.3% of variance in word recognition in a hierarchical regression which controlled for phonological processing. As noted in the section on orthographic knowledge, there have been some studies that have explored the contribution of word specific and general orthographic knowledge for reading in transparent orthographies which showed that word specific and general orthographic knowledge contribute unique variance towards reading (e.g., German: Rothe *et al.*, 2015; Zarić *et al.*, 2020; Persian: Arab-Moghaddam & Senechal, 2001; Dutch: Bekebrede *et al.*, 2009). This indicates that both word specific and general orthographic knowledge are anticipated correlates of reading for isiXhosa.

As there are no studies that have considered the relationship between word specific and general orthographic knowledge and reading ability in African languages, this thesis could catalyze future research in this area.

2.4.5. Spelling and orthographic knowledge

Spelling is characterized by the ability to convert spoken language into a correct sequence of written symbols (Mpiti, 2012; Moats, 2010). Spelling is considered a key literacy outcome needed for educational success (Ehri, 1987, Pretorius & Mokhwesana, 2009; Zarić *et al.*, 2020).

In comparison to reading, spelling has been a neglected in research (Geers and Hayes, 2012; Fleisch *et al.*, 2017; Schaefer & Kotzé, 2019; Treiman, 2017). To date, there is no clear understanding of the development of spelling across languages. However, there are a number of theorists and researchers who have posited explanations. While this thesis will not be looking at spelling development as it is not longitudinal, a brief summary of the literature on the development of spelling is provided below.

Gentry's (1982) stage model is often referred to in the literature. His model describes that learners learn spelling in five different stages characterized by a developmental shift from a dependence on phonological information to a reliance on orthographic and morphological information (Schlagel, 2007; Bourassa & Treiman, 2010). Ellis' (1993) dual route model describes that spelling, similar to reading, can be processed via either a sub-lexical or lexical route. The sub-lexical route describes a reliance on sound-to-spelling regularities and the lexical route describes a reliance on the access of word specific orthographic information. Those who have used this approach to explain spelling development have shown that learners learning in a transparent orthography (e.g., Czech: Caravolas & Bruck, 1993) use the sub-lexical route more predominantly for spelling (Angelelli *et al.*, 2018). However, this approach for understanding spelling development has been criticized for not wholly describing the interaction between phonological and orthographic knowledge. However, Babayiğit (2009) states that learners are likely accessing both phonological and orthographic knowledge in the early stages of spelling development, but that this would depend on the task being performed and learners' level of alphabetic knowledge, PA, and exposure to print. Thus, there is an overall consensus for both English-based studies and cross-linguistic research that spelling development demands knowledge of letter-sound knowledge, PA, morphological awareness, and orthographic knowledge (English: Apel *et al.*, 2012; Finnish, Greek, and English: Georgiou *et al.*, 2012; English, Spanish, Slovak, and Czech: Caravolas *et al.*, 2012).

Ganske (1999) states that spelling has been understood for many years as a means for researchers to learn about learners' emerging orthographic knowledge. Several studies attest to the fact that orthographic knowledge is considered a common underlying skill for both spelling and reading (Ehri, 1980; Morris & Perney, 1984; Juel *et al.*, 1986; Ehri, 1987; Zutell & Rasinski, 1989; Gill, 1992 as cited in Ganske, 1999).

Studies that have looked at the relationship between orthographic knowledge and spelling have shown that orthographic knowledge is important for spelling, as learners are expected to engage with the orthographic features of a language, such as the alphabetic principle, within word patterns and syllable structure (Fleisch *et al.*, 2017). In addition, spelling and spelling errors have been used in an assessment of learners' orthographic knowledge (Masterson *et al.*, 2006; Masterson & Apel, 2010a, 2010b). Templeton and Morris (2000) state that learners' ability to spell a word can provide an indication of their orthographic knowledge, implying a relationship between orthographic knowledge and spelling. Zarić *et al.*'s (2020) study with German children showed that word specific as well as general orthographic knowledge contributes to spelling performance, beyond that of intelligence and PA.

Rothe *et al.* (2015) also considered German learners spelling development. Their study revealed that general orthographic knowledge predicted significant variance to spelling. Similarly, Ouellette and Senechal (2008) found that orthographic pattern knowledge has been found to be a predictor of spelling surpassing the variance explained by phonemic awareness in English. Zhao *et al.* (2017) performed a study in which orthographic awareness was tested using orthographic knowledge tasks with English learners. Their findings showed that word specific orthographic knowledge was the dominant predictor of word spelling in English, contributing 29.4% of the variance in spelling.

To date, there are no studies that have considered the role of orthographic knowledge in relation to spelling in an African language, however, based on the research mentioned above, a relationship between orthographic knowledge and spelling is positively assumed in isiXhosa. The findings of this study will be able to contribute to the understanding of the relationship between these variables in languages other than English.

2.5 Related theoretical theories of reading

There are currently very few theories that address both reading and spelling development, with most theories focusing only on reading. Similarly, the two theories (self-teaching hypothesis and dual route model of orthographic processing) discussed below address reading development; however, they incorporate the role of orthographic skill to a considerably larger degree than traditional reading theories. Further, these theories will be used in the data interpretation included in the Discussion ([Chapter 5](#)). However, it is important to highlight that a well-established theory of the role and contribution of orthographic knowledge in reading and spelling development is needed. This model should be able to speak to both universal developmental trends and the more language-specific trends evident from cross-linguistic studies.

2.5.1 Self-teaching hypothesis

Jorm and Share (1983; Share & Jorm, 1987; Share, 1995) propose the self-teaching hypothesis that states that phonological recoding, which is the conversion of print to sound, performs a ‘self-teaching’ function that enables children to acquire word specific orthographic representations necessary for rapid and efficient word reading (Cunningham, 2006). Share (1995) argues that knowledge of orthographic structure in language is acquired incidentally when reading. The rationale here is that phonological recoding is a reliable and sufficient means for the independent development of the orthographic representations, in particular word specific orthographic representations, that are essential for skilled reading and spelling (Share, 1995). However, Share (1995) states that the decoding skill is not an

assurance that self-teaching will take place; rather, it only offers opportunities for self-teaching. According to Share (1995), there are other factors that can determine whether these opportunities will be exploited; for example, the quantity and quality of exposure to print along with the ability and tendency of readers to attend to and recall orthographic detail in print.

Typically in self-teaching studies, participants are asked to phonologically recode target words which can be either real or nonwords, in isolation or connected text. Their orthographic learning of these target words are then tested three to seven days later (Loveall *et al.*, 2013). Results of such self-teaching studies have demonstrated that when participants phonologically recode target words, they exhibit orthographic learning of those targets in subsequent days. In addition, some studies assert that children's phonological recoding of target words predicts the degree of their orthographic learning as those who showed phonological recoding skill had greater orthographic learning, measured with orthographic knowledge tasks (Nation *et al.*, 2006; Cunningham, 2006; Cunningham *et al.*, 2002; Ouellette & Fraser, 2009). Interestingly, the assessment of orthographic learning only included word specific orthographic knowledge and not general orthographic knowledge. This presents a gap in the theory worth exploring.

Further, there are inconsistencies in the measurements used in these studies. As noted above, some studies used pseudowords, some real, and some connected texts as the phonological target words. Depending on the stimuli used, different contributing factors might be affecting the orthographic learning outcome results. For studies where pseudowords are used, results may be fairer, as this limits the possibility that orthographic learning results can be attributed to prior orthographic knowledge or contextual guessing as the words are unfamiliar (Cunningham, 2006). However, when using real words there are additional syntactic and semantic information available when reading which may lead to the use of contextual guessing thus influencing the outcome results of orthographic learning (Cunningham, 2006). This calls into question generalizations made by these studies regarding the interdependence between phonological recoding and orthographic knowledge.

Further, the hypothesis makes observations about the development of orthographic structures, in saying that once letter strings have been decoded successfully, a limited number of future successful encounters with the word are enough to include that word into the reader's orthographic lexicon and thus this is how the readers orthographic lexicon expands (Share, 1995). This suggests that the development of one's orthographic lexicon is conditioned by the development of decoding skills in a

linear fashion. Burt (2006), in support of the self-teaching hypothesis, states that orthographic knowledge should be regarded as an outgrowth of phonological skills and not as a separate skill.

Counter arguments include that while it may be evident that word specific orthographic knowledge is reliant on phonological skill to some degree, if the capacity of one's orthographic lexicon was entirely a consequence of phonological processes, then orthographic knowledge should not present independent variance (Cunningham *et al.*, 2011). Thus, following the assumption of the self-teaching hypothesis, word specific orthographic knowledge should not explain variance in word recognition skill when the contribution of phonological skill has been statistically controlled for (Cunningham *et al.*, 2011). However, studies show that even when phonological skills are controlled for, word specific orthographic knowledge explains significant additional variance in reading and spelling ability (Stanovich & West, 1989; Cunningham & Stanovich, 1990; Barker *et al.*, 1992; Cunningham & Stanovich, 1993). Stanovich *et al.* (1991) found that word specific orthographic knowledge predicted reading ability beyond that of phonemic awareness skills and exposure to print. Roman *et al.* (2009) found similar results that showed that after controlling for phonemic awareness and RAN, word specific orthographic knowledge was the largest predictor for real word reading with English learners. These investigations indicate that word specific orthographic knowledge contributes uniquely to reading, and is therefore an independent and important skill. Connors *et al.* (2011) attempts to explain further the relationship between phonological skill and orthographic knowledge as described by the self-teaching hypothesis by investigating whether orthographic knowledge acts as a mediator between phonological skill and word reading. Their results showed the latter to be true for English reading. This supports the need for further research on this relationship as described by the self-teaching hypothesis. As the above-mentioned studies were mainly done with English participants, greater cross-linguistic evidence is needed to explore the relevance of the self-teaching hypothesis across languages.

The results of this thesis can possibly provide empirical cross-linguistic evidence to either support or deny the main premises of the self-teaching hypothesis, as this thesis attempts to explain the role and relationship of word specific and general orthographic knowledge for reading in isiXhosa while controlling for other metalinguistic variables, including PA, RAN and letter-sound knowledge.

The following section describes the second theory used for data interpretation: the dual route approach to orthographic processing (Grainger & Ziegler, 2011).

2.5.2 The dual route approach to orthographic processing

While this model is relatively new and thus less cited in research, the links between the premises of the model and this thesis are closely aligned in comparison to traditional reading models.

The model builds on the traditional dual-route model (DRM) of reading aloud (Coltheart *et al.*, 1993, 2001). The DRM model makes the distinction between two routes: the lexical route and a sub-lexical route (Coltheart *et al.*, 1993, 2001). It is via the lexical route, sometimes referred to as the direct route, that orthographic information is directly connected to a word's orthographic representation, which then links to one's whole-word phonological representations that allows readers to read words aloud (Coltheart, 2001). This route processes frequent and orthographically irregular words, but not unfamiliar or pseudowords (Levy *et al.*, 2009). In the sub-lexical or phonological route, orthographic information is transformed into a sub-lexical phonological code before connecting with whole-word phonological representations (Coltheart *et al.*, 1993, 2001). This route processes both pseudo- and real words (Levy *et al.*, 2009). A visual depiction of the Dual Route Model is presented below in Figure 2.

The dual route model of orthographic processing also draws from the Bi-modal Interactive-Activation Model (BIAM), illustrated in Figure 3 below, which makes the distinction between sub-lexical (O-units), lexical orthographic (O-words), and phonological (P-units, P-words) representations interacting through a central interface (O-P). Whole-word representations (O-words and P-words) provide access to semantic representations (S-units) (Grainger & Ferrand, 1994; Grainger & Ziegler, 2008; Diependaele *et al.*, 2010). Unlike the DRC model, the BIAM assumes that there is a fast mapping between letter representations and auditory input phoneme representations (Grainger & Ziegler, 2011). These auditory phoneme representations then activate lexical phonological representations (Diependaele *et al.*, 2010).

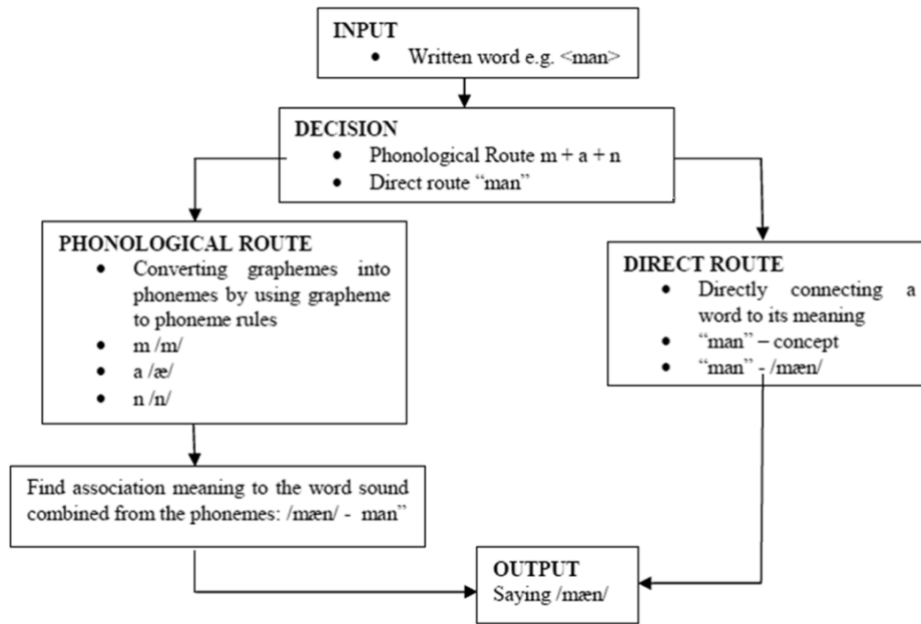


Figure 2: Traditional Dual Route Model (Coltheart *et al.*, 2001)

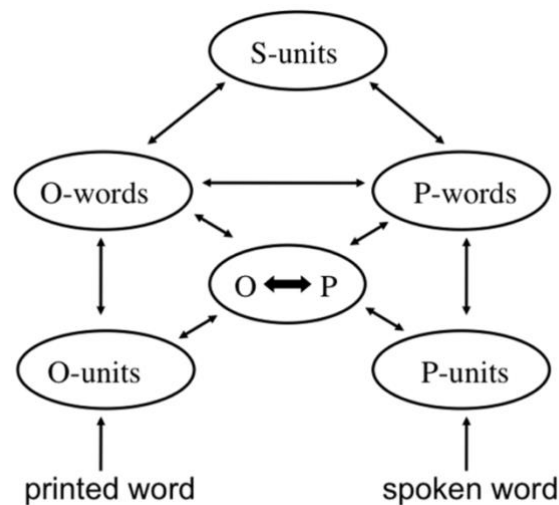


Figure 3: BIAM model (Grainger & Ferrand (1994) as cited in Grainger & Ziegler (2011:2)

A key feature evident from the BIAM model is the inclusion of a single sub-lexical route, as opposed to the traditional division between a sub-lexical and lexical route. Similarly, the dual route model of orthographic processing differs from traditional dual route models as it describes a dual route approach to orthographic processing that proposes two fundamentally different kinds of orthographic sub-lexical routes (Grainger & Ziegler, 2011). According to Grainger and Ziegler (2011:1), the formation of these two routes are borne out of the consideration of the difficulties that occur when learning to “map

orthography onto semantics on the one hand, and orthography onto pre-existing sub-lexical morphological and phonological representations, on the other”, along with additional coding constraints related to this process. Thus, the model hypothesizes that these constraints force the system to develop two separate sub-lexical routes.

The model focuses on silent word reading with the general aim of providing an account of how readers are able to take in print information and recover semantic information given the constraints listed above (Grainger & Ziegler, 2011). The dual route approach to orthographic processing is illustrated in Figure 4.

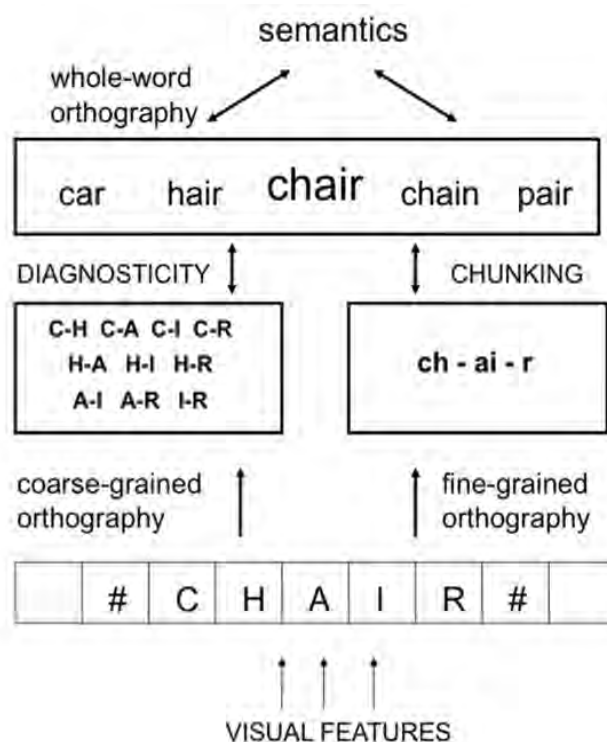


Figure 4: Dual route model of orthographic processing (Grainger & Ziegler, 2011:3)

As noted above, the model makes the distinction between two sub-lexical routes. This can be seen in Figure 4. On the left-hand-side, there is the coarse-grained orthographic code that is linked to diagnostic processing of letter combinations (Grainger & Ziegler, 2011). This means that readers focus on the distinct orthographic characteristics of words to ‘diagnose’ the whole-word orthographic representation. In this, the frequency at which particular letter strings occur in the language determines the likelihood that a particular combination of letters belongs to the input word (Grainger & Ziegler, 2011). The strategy of this route is to identify the letter combinations that best represent the word identity of the input word (Grainger & Ziegler, 2011). This is not a guaranteed means of word

recognition, but rather a means to provide rapid bottom-up activation of whole-word representations (Grainger & Ziegler, 2011). Based on this description, it seems that the coarse-grain orthographic code resembles the definition of word specific orthographic knowledge, or, more specifically, provides a pragmatic approach to the processing of word specific orthographic knowledge.

On the right-hand side is the fine-grained orthographic code that is linked to the process of ‘chunking’ letter combinations (Grainger & Ziegler, 2011). In this route, the frequency of co-occurring letter combinations enables the reader to ‘chunk’ these combinations together to reduce the amount of information being processed when reading new words (Grainger & Ziegler, 2011). Unlike the coarse-grained orthographic route, this route provides more precise information about the order and pattern of letters strings (Grainger & Ziegler, 2011). This allows readers to recognize multi-letter graphemes which then activate their respective phonemes linked to their whole-word phonological representation, and finally their semantic meaning (Grainger & Ziegler, 2011). Grainger and Ziegler (2011) state that whilst this may seem to represent a model-guided definition of general orthographic knowledge used for reading, it is important to note that this route is more generally dedicated to identifying precisely the letter-position patterns of letter identities for the facilitation of the ‘chunking’ of frequently co-occurring adjacent letter combinations, for example, complex graphemes and small morphemes such as affixes (Grainger & Ziegler, 2011). This route hypothesizes that in order to optimize reading, the development of orthographic representations is needed in order to facilitate the mapping of letter representations onto pre-existing sub-lexical phonological representations. While Grainger and Ziegler (2011) advised that the model should not be purely understood as a model-guided definition of general orthographic knowledge, the similarities between their characteristics are clearly apparent. Thus, it can be suggested that the fine-grained orthographic code provides an explanation of the possible processing of general orthographic knowledge when reading. Further, in consideration of the above description, one can make the inference that readers of a language that is rich in morphological letter combinations and complex graphemes would benefit from the use of this particular processing route.

Figure 5 below provides an illustration of the proposed linkage between the two routes described in the dual route model of orthographic processing (Grainger & Ziegler, 2011) and word specific and general orthographic knowledge, using an isiXhosa example.

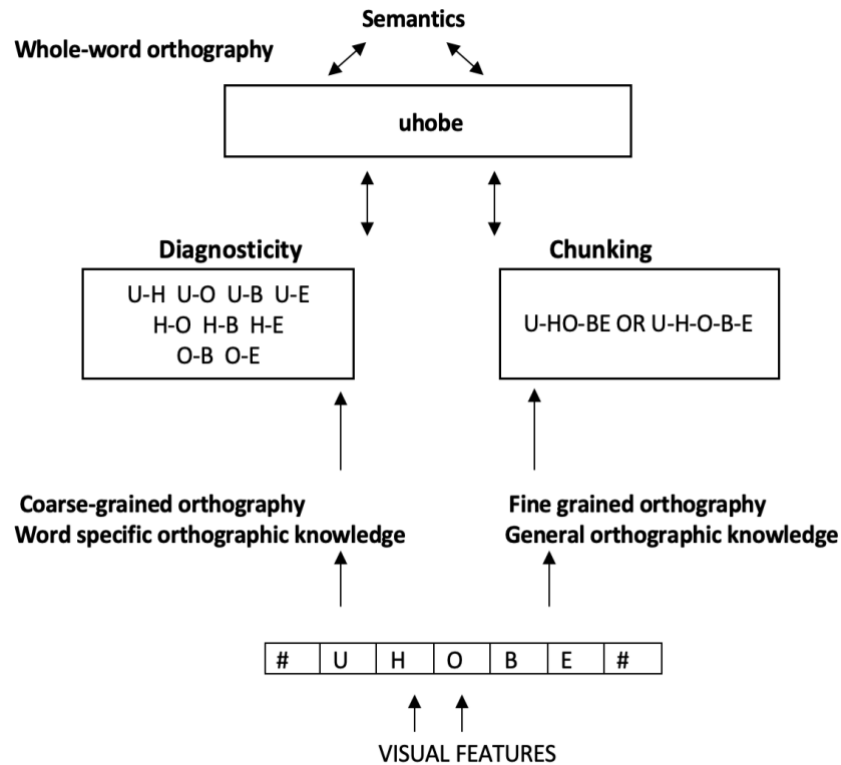


Figure 5: Adapted version of dual route model of orthographic processing (Grainger & Ziegler, 2011) based on thesis predictions

In terms of the implications of the dual route approach to orthographic processing and word reading development, Grainger and Ziegler (2011) state that they agree with the self-teaching hypothesis in saying that phonological recoding is a critical first step in reading acquisition (Share, 1995). However, they propose that it is during this process of phonological recoding that the exposure to printed text enables the setting-up of the parallel orthographic processing system hypothesized by their model. This is distinctively different to the premise of the self-teaching hypothesis that states that this relationship is dependent rather than working in parallel to one another as promoted by Grainger and Ziegler’s (2011) approach. The general account provided by Grainger and Ziegler (2011) of learning to read words is that the initial predominance of phonological recoding, as proposed by Share (1995), should be replaced by parallel orthographic processing.

According to Grainger and Ziegler (2011), this parallel orthographic processing will lead to a number of benefits. These include: the rapid access to semantic representations via the coarse-grained orthographic route, more efficient sub-lexical conversation of orthography to phonology via the fine-grained orthographic route, and through a combination of coarse-grained and fine-grained

orthographic processing, the emergence of morpho-semantic and morpho-orthographic representations (Grainger & Ziegler, 2011).

In consideration of the arguments of the dual route approach to orthographic processing, the following can be said in relation to this thesis. Firstly, as noted above, the coarse-grained orthographic code seems to provide a pragmatic approach to the accessing of word specific orthographic knowledge, and the fine-grained orthographic code provides an explanation of the possible processing of general orthographic knowledge, thus, presenting a potential explanation of the processing of these components when reading. Secondly, based on the above conjectured connections, findings from this thesis could provide insights into the orthographic processing routes used by the participants when reading in isiXhosa. That is, if word specific or general orthographic knowledge is found to be a greater contributor of reading in the sample, this might provide an indication of the orthographic processing routes employed by the learners. As previously mentioned, based on the description of the fine-grained orthographic route, it is hypothesized that learners learning to read in a language that is morphologically rich and has a variety of complex graphemes, like isiXhosa, would benefit from the use of this route.

2.6 Summary of literature review

In summary, this chapter has mainly shown that there is no research on the role and relationship of word specific and general orthographic knowledge and literacy skills and outcomes in the Southern Bantu languages, motivating the need for the investigation promoted in this thesis. A summary of the main concepts discussed in the literature review is included below.

Firstly, an overview of orthography, isiXhosa language structure, and the history of isiXhosa orthography were provided to present a general background and contextualization to the key concepts of the thesis in [section 2.2](#). Following this, an in-depth explanation of orthographic knowledge and the fact that it consists of two main parts, word specific and general orthographic knowledge, was presented in [section 2.3](#). This section also showed that the measurement of orthographic knowledge, while inconsistent, includes mainly an orthographic choice task, assessing word specific orthographic knowledge, and a permissible letter string task, assessing general orthographic knowledge. Both of these tasks have rarely been administered with transparently written languages, and thus, specific measures of word specific and general orthographic knowledge were developed for use in the current thesis taking into consideration the language structure of isiXhosa.

The relationship between orthographic knowledge and the additional metalinguistic skills and outcome variables of interest in this thesis (letter-sound knowledge, PA, RAN, reading and spelling) were discussed in [section 2.4](#). Overall, more information about orthographic knowledge and its relation to letter-sound knowledge, PA, RAN, spelling and reading is needed in the Southern Bantu languages. However, international research confirms links between orthographic knowledge and letter-sound knowledge, PA, RAN, reading and spelling. Based on the research presented, it is suggested that relationships between all of these variables will be evident in isiXhosa.

Lastly, a detailed account of the two reading theories of focus in this study was discussed. Specifically, the main arguments of the theories were presented along with explanations of how these arguments will be used in data interpretation in order to ascertain how the findings from the current study can be situated within the assertions of the self-teaching hypothesis and the dual route approach to orthographic processing.

CHAPTER 3: METHOD

3.1 Introduction

The current cross-sectional, correlational, quantitative study investigates the role of orthographic knowledge for isiXhosa. In doing so, it aims to provide insight into the linguistic nature of orthographic knowledge in isiXhosa; in particular, how this knowledge and its components (general and word specific orthographic knowledge) should be measured in isiXhosa and what the unique predictors of word specific and general orthographic knowledge are for isiXhosa. Further, the thesis explores whether word specific and general orthographic knowledge are possible key literacy skills needed for successful reading and spelling in isiXhosa, while also considering the role of other metalinguistic variables, namely, phonological awareness (PA), rapid automatized naming (RAN), and letter-sound knowledge.

To achieve these objectives, orthographic knowledge, ORF, spelling, PA, RAN, and letter-sound knowledge were measured with grade 3 isiXhosa learners in order to answer the following research questions:

1. What is the orthographic knowledge (word specific and general) of grade 3 isiXhosa home language learners?
- 2 a. What is the relationship between letter-sound knowledge, RAN (item and letter-naming), PA and word specific orthographic knowledge in grade 3 isiXhosa home language learners?
b. What is the relationship between letter-sound knowledge, RAN (item and letter-naming), PA and general orthographic knowledge in grade 3 isiXhosa home language learners?
- 3 a. What are the unique contributions of orthographic knowledge (word specific and general), letter-sound knowledge, RAN (item and letter-naming) and PA to reading in grade 3 isiXhosa home language learners?
b. What are the unique contributions of orthographic knowledge (word specific and general), letter-sound knowledge, RAN (item and letter-naming) and PA to spelling in grade 3 isiXhosa home language learners?
4. How can the findings from the above research questions be situated within the assertions of the self-teaching hypothesis and the dual route approach of orthographic processing?

The data collection was conducted in two phases. The first phase was the pilot phase which was followed by the main data collection in consideration of the outcomes of the pilot phase. This chapter outlines the specific measures and procedures that were used for both phases. In particular, details

regarding ethical clearance and consent, participants and schooling, the development and procedures of each of the tasks measured, and post task coding and data analysis are included.

3.2 Ethical clearance and consent

All learners participated on a voluntary basis for both phases of data collection. In addition, the learners' parents returned signed consent forms permitting them to take part in the study. The learners themselves provided verbal assent prior to being assessed. These learners were also told that they were allowed to stop the testing at any point with no repercussions. In addition, if the task proved too difficult for the child, the task was broken off. The consent form provided to the parents is included in [Appendix 2](#). The learners identities were kept anonymous as each learner was given a unique code. Ethical clearance was obtained from the Rhodes University Ethical Standards Committee 2020-1195-3307 and the Department of Basic Education (Eastern Cape). Copies of the relevant documentation are in [Appendix 3](#).

3.3 Pilot phase

3.3.1 Introduction

As the focus of this thesis is on the investigation of orthographic knowledge in isiXhosa, this section considers the piloting of the word specific and general orthographic knowledge tasks that were specifically designed for use in this thesis and thus have never been conducted before. As the other tasks in this thesis were not specifically designed for this thesis they were not piloted. The participants and schooling context as well as the development and procedures used for the word specific and general orthographic knowledge task are discussed. In addition, the findings, and the impact thereof for main data collection, are outlined in this section.

There were three main objectives of the pilot phase. These are listed below:

- To assess the feasibility of the data collection procedures used for the word specific and general orthographic knowledge tasks and to identify potential weaknesses or limitations before the main data collection;
- To examine the reliability of the word specific and general orthographic knowledge tasks;
- To test whether there were ceiling or floor effects evident in the data reflective of task complexity issues.

3.3.2 Participants and schooling context

The pilot phase included 21 grade 3 learners at one Quintile 3 non-fee-paying school in Kwanobuhle, Uitenhage, Eastern Cape. This school was chosen as it is an isiXhosa medium of instruction school. While learners from this school were also included in the main data collection phase, the learners in the pilot phase were assessed in the fourth term of 2020 and thus were not assessed in the main data collection phase as this was done in the first term of 2021. The learners in the pilot phase were thus in grade 4 at the time of main data collection. As these learners were at the end of grade 3, it was assumed that they have a level of mastery in foundational literacy skills in their home language, given that it is their final year of being taught in their home language before transitioning to English. Thus, these learners are eligible to complete the grade level of testing required for the pilot phase. The pilot sample was purposive with the proportion of boys being 62% (N = 13), and 38% (N = 8) for girls. The average age was 9.2 years old.

3.3.3 Orthographic knowledge tasks

Orthographic knowledge was measured in two ways to assess word specific and general orthographic knowledge. The word specific and general orthographic knowledge tasks were conducted visually to eliminate, as far as possible, the direct influence of phonology.

3.3.3.1 Word specific orthographic knowledge

Word specific orthographic knowledge refers to one's memories of specific words and their parts as well as their phonological representations (Apel, 2011). This knowledge requires the mapping of printed words onto single and specific word names (Loveall *et al.*, 2013).

3.3.3.1.1 Task development

As noted in [section 2.3.1](#), the most commonly used measure for word specific orthographic knowledge has been the orthographic choice task, also referred to as a homophone choice task (Olson *et al.*, 1994; Conrad, 2008; Ricketts *et al.*, 2008; Sears *et al.*, 2008; Papadopoulos *et al.*, 2009; Tong *et al.*, 2009 as cited in Apel, 2011; Loveall *et al.*, 2013). Typically, in this task, participants are required to make a judgment between two written words in which they need to choose the word that represents a real word in their language (Apel, 2011). In practice, the learners would be asked to simply indicate which one was spelled correctly (Cunningham, 2001). In general, the pair of written words would include one real word and a second phonetically similar and orthographic dissimilar word which would be the incorrectly spelled form of the first word, referred to by some as a pseudohomophone, for example, in

English: *train* and *trane*, *rain* and *rane*, *take* and *taik*, *gote* and *goat*, *sleap* and *sleep* (Cunningham & Stanovich, 1990; Manis *et al.*, 2000). Since the pair of words sound the same when decoded, differences in phonological decoding cannot be the primary reason for the learner's performance on the task, while it may still be somewhat influential (Cunningham *et al.*, 2001).

This task can potentially be critiqued along the lines that learners may rely on their memory of these words when completing the task, introducing a frequency effect in which the recognition of the correct word may simply be the result of learners' frequent or infrequent exposure or awareness of these words. In response to this, it is worth noting the arguments of Ellis (2002), asserting that language learning based on frequency and probability is still considered important for overall language development, and should not be discredited. Furthermore, the task itself implies that learners should have retained the specific orthographic representations of real words that they have frequently encountered in order to select successfully the real word from the pair of stimulus words. Therefore, frequency is an inherent variable in the task itself and will inevitably play a necessary role.

However, the fact that the learner still has to make a judgement between a pair of words means that the task primarily requires learners to examine the orthographic representation of the pair of words and not simply to identify the more frequent word (Cunningham *et al.*, 2001). Furthermore, the task reflects learner's accessibility to real word orthographic entries in their lexicon as they are required to retrieve this information to correctly complete the task, thus, motivating the task's assessment of word specific orthographic knowledge.

This task has mainly been conducted in English, and was therefore designed to suit the structure of English. As such, the task requires the language in which orthographic knowledge is being assessed to have both a variety of homophonic sounds, which typically occur in languages with opaque orthographies, and a variety of short and non-complex words which are easy to parse for the assessment of foundation phase learners orthographic knowledge. Due to the transparent and conjunctive orthography of isiXhosa, these features are not common in the language, and this task is therefore not feasible for isiXhosa. For this reason, a word specific orthographic knowledge task was specifically designed for this study which was more suited for the assessment of isiXhosa learners' word specific orthographic knowledge.

In keeping with the premise of a standard word specific orthographic knowledge task, which is used to assess learners' recall of specific words and their individual parts (Apel, 2011), the learners in the

pilot phase were asked to identify the incorrect additional letter from largely familiar words in isiXhosa.

In order to complete this task, learners must access their word specific orthographic knowledge in an attempt to identify the correct underlying real word. They need to decode the stimulus word and map it onto either a sound representation, which might prove difficult as many of the stimulus words and underlying real words were phonetically similar to one another, or, more appropriately, they would map it onto the correct orthographic representation of the underlying real word in their mental lexicon. Thereafter, they would need to compare the two spellings of the stimulus word and underlying real word and correctly identify the incorrect letter that does not fit into the orthographic representation of the real word.

There were a number of linguistic decisions made for the creation of the stimuli for the word specific orthographic knowledge task. The underlying real words, hereafter referred to as ‘base’ words, were sourced from a list of 300 top high frequency words in isiXhosa drawn from a corpus of 170000 tokens of isiXhosa words compiled by Rees and Randera (2017). This list was then split into four categories: top frequency (1-75), middle frequency (75-150), upper bottom frequency (150-225), and lower bottom frequency (225-330). Words were chosen strategically from each of these four categories in order to provide a range in complexity based on frequency. This was done with the understanding that the more familiar the word, the easier it is to retrieve its orthographic representation (Monsell *et al.*, 1989).

Further, because of isiXhosa’s agglutinative linguistic structure and conjunctive orthography, what constitutes a ‘word’ in this language is complex. This means that words in isiXhosa are typically longer and densely packaged with morphological information. In other words, one linguistic word may correspond to a number of words in a non-agglutinative language and languages with disjunctive orthographies. For example, in isiXhosa the word *ndiyakuthanda* (English: I love you) corresponds to three orthographic words in English, which is a non-agglutinative language. To resolve this issue, the ‘base’ words chosen for this task were simple lexical words with little morphological intricacy, so as to not to add additional complexity detracting from the orthographic features of the words which the task required the learners to pay attention to. For example, words such as *ngubani* (English: who is he?) would not be included in the task as there are several morphemes in this word which correspond to individual meanings which may divert the learners’ attention. Thus, words such as *inja* (English: dog) were chosen as there is only one morpheme which corresponds to a single meaning.

Additionally, the task stimuli ranged in complexity in terms of word length in syllables. Studies have shown that word length can increase the difficulty of a task because of the greater number of units that need to be paid attention to (Saiegh-Haddad *et al.*, 2010). Thus, the words ranged in length in syllables with four bisyllabic words, four trisyllabic words, and four quad-syllabic words. Furthermore, there was, for the most part, equal variation in the placement of the incorrect letter within stimuli words. Learners were required to identify an incorrect letter from the initial, medial, and final word position in each set of word lengths in syllables. Since there were four words in each length set, there remained an extra word in each set for which a place of identification needed to be assigned. As a result, in the bisyllabic set, an extra word medial identification was assigned as this is considered the most difficult placement of word manipulation. This is based on research on PA tasks which indicate that the placement of the manipulation in words affects the task complexity (Saiegh-Haddad *et al.*, 2010). In contrast, bisyllabic words are the shortest and thus are considered easier in terms of length complexity as there are less syllables to parse, placing less stress on one's working memory (Alloway *et al.*, 2004; Gillon, 2004). The logic was then that these two qualities would counterbalance making it a fair task item. For the trisyllabic set, an extra word final identification was assigned and for the quad-syllabic set, which was the most complex in terms of word length in syllables, an additional word initial identification was assigned as this is considered the easiest identification (Saiegh-Haddad *et al.*, 2010). Once more, the logic was that these qualities would counterbalance making the task item fair.

Lastly, as mentioned above, the stimulus words were phonetically similar to the 'base' words. This was done so that differences in phonological decoding cannot be the primary reason for the learner's performance on the task. Further, the list of task items used were checked by a home language isiXhosa speaker to ensure that they were not real isiXhosa words.

Given that the learners in the sample were in grade 3, the task difficulty level seemed appropriate, keeping in mind that as learners develop cognitively, their ability to perform increasingly explicit tasks increases (Anthony & Francis, 2005). In total, there were 12 task items and two practice items. The full list of task stimuli used can be seen in Table 2 below. The linguistic decisions as discussed above are also illustrated in Table 2.

Table 2: Pilot phase word specific orthographic knowledge task

Stimulus word	Letter to be removed	Position of incorrect letter	'Base' real word	English translation	Frequency	Length
1. zonkhe	'h'	final	zonke	all	top	bisyllabic
2. ingja	'g'	medial	inja	dog	middle	bisyllabic
3. nxceda	'x'	initial	nceda	please	lower bottom	bisyllabic
4. borna	'r'	medial	bona	see	bottom	bisyllabic
5. iminyi	'y'	final	imini	day	top	trisyllabic
6. kwuphela	'w'	initial	kuphela	only	middle	trisyllabic
7. ingcwadi	'g'	medial	incwadi	book	lower bottom	trisyllabic
8. umhlabaa	'a'	final	umhlaba	the world	bottom	trisyllabic
9. amangama	'n'	medial	amagama	words	top	quad-syllabic
10. encinanje	'j'	final	encinane	small	middle	quad-syllabic
11. amazinyo	'a'	initial	amazinyo	teeth	lower bottom	quad-syllabic
12. ambafulundi	'm'	initial	abafundi	students	bottom	quad-syllabic

3.3.3.1.2 Task administration and scoring

The task was administered by trained isiXhosa home language research assistants. The research assistants presented the task visually to the learners with each letter of the stimuli words presented on a separate small card so that the learner could physically remove the incorrect letter from the stimuli words. The research assistants were further instructed not to read the stimulus words aloud to the learners to avoid unconscious correction of the stimulus words in speech. The learners were then told by the research assistant that they would be shown some words that are spelled incorrectly and that they should pick up the card that represents the incorrect letter in the word. For example, the stimulus word *zonkhe* would be presented to the learner, and the learner would have to physically pick up the card that represented the incorrect letter (i.e. <h>). They were first given two practice examples to complete to assist with their understanding of how to complete the task before attempting the actual task. The learners' answers were recorded by the research assistant on a separate marking sheet. If the learner chose the correct 'incorrect' letter they received a score of 1 and if they chose the incorrect 'incorrect' letter they received a score of 0.

This task was administered on a one-on-one basis and took approximately 10 – 15 minutes per learner. The learners were given no corrective feedback and their answers were only acknowledged by the research assistant as a means to indicate that they can continue to the next stimulus item.

3.3.3.2 General orthographic knowledge task

General orthographic knowledge refers to an individual's knowledge of the orthographic patterns which govern how speech must be represented in a particular orthography (Apel, 2011). To recap, examples of governing orthographic rules include: 1) knowledge of the alphabetic principle, 2) the understanding of how to represent sounds which extend past one-to-one correspondences, for example, complex graphemes in isiXhosa, 3) restrictions on letter combinations, for example, the letters <jr> together are not a legal combination in isiXhosa, and 4) the rules which govern the positions in which letters cannot be used, for example, in isiXhosa, the grapheme <ng> cannot occur in the coda or word final position, and, as an extension of isiXhosa's consonant vowel structure, words cannot end in consonants (Apel, 2011).

3.3.3.2.1 Task development

[Section 2.3.1](#) noted that the assessment of orthographic pattern knowledge typically measures participants' awareness of permissible letter patterns and orthographic pattern rules used in the language of testing (Cassar & Treiman, 1997; Cunningham *et al.*, 2001; Levy *et al.*, 2006; Verhoeven *et al.*, 2006; Georgiou *et al.*, 2009; Apel *et al.*, 2010 as cited in Apel, 2011). This type of task is generally referred to as the letter-string choice task and is fairly similar to the orthographic choice task, mentioned in the previous section, as participants are once again asked to make a judgement between a pair of words. However, instead of a pair of real words, the pair contains one pseudoword and one nonword. A nonword refers to a word that is not accepted as a word by home language speakers of a language, whereas a pseudoword is a word that looks like a word that could be accepted by a home language speaker but does not have any real meaning in the language (Merriam Webster, 2020). The participants are required to choose the pseudoword from the pair as this word resembles a real word in the language, in that it conforms to the orthographic patterns which characterize the language, but has no semantic meaning. For example, in English, choosing *beff* instead of *ffeb* (Zhao *et al.*, 2017). In practice, participants are asked to circle the word which most resembles a real word in their language. However, the task can be critiqued for only providing two options for the learners to choose between, as this compromises the validity of the measure through increasing the probability of correct guessing. This means guessed answers will need to be taken into account when considering the results of this type of task.

As this task does not have any particular language-specific prerequisites, it can mostly be applied for usage in isiXhosa, with some adaptations. Thus, the general orthographic knowledge task used was specifically designed for isiXhosa, while taking into consideration how the literature reports general orthographic knowledge is measured. The current task includes the use of three options instead of two to avoid the effect of guessed answers. There were two nonwords and one pseudoword. The learner needed to correctly identify the pseudoword from the three words. The use of pseudowords and nonwords means that learners cannot rely on their word specific orthographic knowledge, nor grapho-phonemic knowledge, ensuring that individuals will have to use their knowledge of the specific orthographic patterns of isiXhosa. The order in which the pseudoword appeared in the set of three words was randomized to ensure that learners could not rely on a pattern when identifying the pseudoword.

Further, the words ranged in complexity in terms of word length in syllables, namely: four bisyllabic, four trisyllabic, and four quad-syllabic words, as studies have shown that word length increases the difficulty of a task (Saiegh-Haddad *et al.*, 2010).

In order to complete this task, the learners must access their general orthographic knowledge and evaluate the permissibility of the letter patterns in the stimulus words. They would first need to decode each of the three stimulus words and map it onto their orthographic representations and possibly phonetic representations. Thereafter, they would need to compare each of the three stimulus words to their own knowledge of the permissible orthographic patterns of isiXhosa in order to select the correct word which most conforms to the orthographic patterns of isiXhosa.

In total, there were 12 task items and two practice items. A list of the task stimuli used can be seen below in Table 3. The task items were checked by a home language isiXhosa speaker to ensure that none of the task items were real isiXhosa words.

Table 3: Pilot phase general orthographic knowledge task

Task items	Correct answer	Word length
1. dethu vs. mdethu vs. denthu	dethu	bisyllabic
2. wacx vs. waca vs. wacka	waca	bisyllabic
3. katsho vs. kathso vs. katzo	katsho	bisyllabic
4. phend vs. phendi vs. phedni	phendi	bisyllabic
5. jobisi vs. jrobisi vs. jobisee	jobisi	trisyllabic
6. dwasepe vs. wasepe vs. watshepe	wasepe	trisyllabic
7. belezwi vs. belezywi vs. nbelezwi	belezwi	trisyllabic
8. ondawo vs. omdawo vs. ondwawo	ondawo	trisyllabic
9. izantzipe vs. izantsipe vs. izantsiqi	izantsipe	quad-syllabic
10. ndoxele vs. ndodxele vs. ndoncxele	ndoxele	quad-syllabic
11. cwalaba vs. mcwalaba vs. cxwalaba	cwalaba	quad-syllabic
12. mfahlaba vs. mvahlaba vs. mnvahlaba	mvahlaba	quad-syllabic

3.3.3.2.2 Task administration and scoring

This task was administered on a one-on-one basis by trained isiXhosa home language research assistants and took approximately 5-10 minutes per learner. The task was presented visually, and the research assistants were instructed not to read the stimulus words aloud to the learner. Each set of stimuli was presented to the participants on A4 sheets of paper. The research assistant told the learner to point the word that looks like a real isiXhosa word or like a word they might find in an isiXhosa book. The research assistant then indicated on their marking sheet what word the learner pointed to. If the learner chose the correct word, they received a score of 1, and if they chose the incorrect word, they received a score of 0. They were first given two practice examples to complete with the research assistant to assist with their understanding of how to complete the task before attempting the actual task. The learners were given no corrective feedback; their answers were only acknowledged by the research assistant so that the learner would know that they can continue to the next stimulus item.

3.3.4 Findings of pilot phase

The findings of the pilot phase will be discussed in line with the main objectives of the pilot phase as outlined in [section 3.1](#). The first objective was to assess the feasibility of the data collection procedures used for the word specific and general orthographic knowledge tasks in order to identify potential weaknesses or limitations before main data collection. As noted above, the word specific orthographic knowledge task took approximately 10 - 15 minutes per learner, which is quite long considering learners would need to complete an additional seven tasks in the main data collection phase. Thus, this would not be feasible, and the time taken to complete the task would need to be reduced substantially. Therefore, for the main data collection phase it was decided that the stimuli would not be presented individually on cards as this took too much time for the research assistant to set up for each word. Rather, it would be presented on a single A4 page in large font, and the learner would simply point to the incorrect letter. This procedure is discussed in greater detail in the main data collection phase ([section 3.5.2.1.1](#)). The time taken to complete the general orthographic knowledge task seemed reasonable and thus the procedures were not adjusted.

The second objective of the pilot phase was to examine the reliability of the word specific and general orthographic knowledge tasks. The results revealed that the word specific task was very reliable ($\alpha=0.82$) and the general orthographic knowledge was moderately reliable

($\alpha=0.62$) as measured by Cronbach alpha reliability statistical analyses (Rosenthal & Rosnow, 1991).

There were several issues with the task stimuli of the general orthographic knowledge. Item 12 negatively correlated with the total scale and thus needed to be reversed, and item five showed no variance and needed to be deleted. These items were deleted and replaced with more appropriate stimuli. Item nine was also replaced as post task reflections revealed discrepancies in the letter combinations used. Further, items 10 and 11 were also edited in that additional syllables were added to the stimuli words as the incorrect number of syllables was included in the pilot stimuli. These alterations were all made to enhance the task for the main data collection phase.

In terms of the validity of the measures, the main approach taken to ensure validity was to use theory evidence to support the task design (Golafshani, 2003). This was done by ensuring that the design of the measures used in the study took into consideration how orthographic knowledge has been previously assessed based on the theory surrounding orthographic knowledge (see sections [3.3.3.1](#) and [3.3.3.2](#) above). A confirmatory factor analysis should be done to further strengthen the homogeneity of the instrument and is suggested for further research.

The final objective was to test whether there were ceiling or floor effects evident in the data reflective of task complexity issues. The data showed that learners performed marginally better on the general orthographic knowledge task ($M=8.9$, $SD=2.1$) than the word specific orthographic knowledge task ($M=8.7$, $SD=3.1$). The results reflect an average of approximately 73% for these tasks and considering that these learners are at the end of grade 3 and the learners who will be assessed in the main data collection will be in the start of grade 3, it is likely that this average will decrease. Thus, based on these results, ceiling and floor effects in the main data collection phase are not expected.

3.4 Main data collection phase

3.4.1 Participants and schooling context

The participants in this study were 140 grade 3 isiXhosa home language learners from five Quintile 3 non-fee-paying schools. However, the schools are fairly well resourced with a teacher and assistant in each classroom and library facilities available at the school. The schools are situated in the township of Kwanobuhle, in Uitenhage in the Eastern Cape. This is a working class community with many of the adult residents working for local businesses in Uitenhage. These schools were chosen as they are all isiXhosa medium of instruction schools. The motivation for including five schools in the area was done with the intention of having a reasonable representation of the characteristics of grade 3 learners in township schools in the Kwanobuhle area.

Participants chosen were assessed in the first term of grade 3 in 2021. This is the beginning of their final year of foundation phase education in their home language, isiXhosa, before learners transition to English medium of instruction in grade 4. Thus, these learners are expected to have a moderate to potentially strong level of mastery of literacy skills in their home language, isiXhosa, and are therefore eligible to complete the grade level tasks of this thesis.

Taking into account the participant parameters mentioned above, the sample was purposive. Overall, more than half the sample were girls (N= 74, 53%), with 47% of the sample being boys (N=66). The average age was 8.42 years old.

The original sample was 186 learners, which was reduced to 140 learners due to missing data and input errors made during the data collection process. The data was collected using a paper based system. While there were attempts to monitor quality throughout the data collection process, the paper based system means that there is little internal data quality management which can be conducted during the process. For example, with electronic and online data collection one can monitor the data as it is captured and detect any errors as they come in, as oppose to detecting them during data capturing which is usually done post data collection when using a paper based system. Thus, it is suggested that future research turn to electronic or online data collection procedures for greater accuracy and data retention, for example, Survey CTO and Tangerine which have been used by a number of research studies and data collection companies, including, for example, EGRS and ikapadata.

3.4.2 Measures

The variables of interest in this study are word specific and general orthographic knowledge, letter-sound knowledge, PA, RAN, ORF and spelling. Thus, these were the skills measured in the thesis. Currently, there are no standardized literacy tasks for isiXhosa. Thus, as previously mentioned, the orthographic knowledge tasks described below were specifically designed for the study. The spelling task was taken from Davies and Probert (2020) and was shown to be a reliable measure in their study, as indicated by a Cronbach alpha reliability test ($\alpha=0.847$). The PA, RAN, and ORF tasks were taken from the EGRA for isiXhosa. The EGRA have been widely used in large-scale studies and have been found to be reliable. Adjustments were made to the spelling and PA tasks used in this thesis which are discussed further in this section.

In the creation of these tasks, consideration was given to previously conducted literacy studies in the Southern Bantu languages as well as to the phonological and orthographic structure of isiXhosa. This section outlines each of the measures that was assessed in the study. In particular, it details the process of their development, administration, and post task scoring. However, as the development of the word specific and general orthographic knowledge tasks were already addressed in the pilot phase, the sections on these tasks will focus mainly on the procedures used in the main data collection phase.

3.4.2.1 Word specific orthographic knowledge task

This task was not adjusted after the pilot phase as it was found to be very reliable ($\alpha=0.82$) as evident from the results of the Cronbach alpha analysis (Rosnow & Rosental, 1991). To recap, there were 12 task items and two practice items. The full list of task stimuli used can be seen again in Table 2 above.

3.4.2.1.1 Task administration and scoring

The task was administered by trained isiXhosa home language research assistants. The research assistants presented the task visually to the learners on A4 sheets of paper where each task item was presented separately on a page. The research assistants were further instructed not to read the stimulus words aloud to the learners to avoid any unconscious correction of the stimulus words in their speech while presenting the task. The learners were told by the research assistants that they would be shown a number of words that are spelled incorrectly and that they should point to the single letter that makes the word spelled incorrectly. For example, the stimulus word *borna* would be presented to the learner on a sheet of paper in large font, and

the learner would have to physically point to the <r> as the incorrect letter in the word. Participants were first given two practice examples to complete to assist with their understanding of how to complete the task before attempting the actual task. The learners' answers were recorded by the research assistants on a separate marking sheet included in [Appendix 4](#). If the learner chose the correct 'incorrect' letter, they received a score of 1, and if they chose the incorrect 'incorrect' letter, they received a score of 0.

This task was administered on a one-on-one basis and took approximately five minutes per learner. The learners were given no corrective feedback; their answers were only acknowledged by the research assistant as a means to indicate that they could continue to the next stimulus item.

3.4.2.2 General orthographic knowledge task

This task was adjusted after the pilot phase. In particular, items 5, 9, 10, 11, and 12 are either replaced or edited versions of the stimuli from the pilot phase to enhance the task's reliability for main data collection. In total, there were 12 task items and two practice items. A list of the task stimuli used can be seen below in Table 4. The task items were checked by a home language isiXhosa speaker to ensure that none of the task items were real isiXhosa words.

Table 4: Main data collection phase general orthographic knowledge task

Task items	Correct answer	Word length
1. dethu vs. mdethu vs. denthu	dethu	bisyllabic
2. wacx vs. waca vs. wacka	waca	bisyllabic
3. katsho vs. kathso vs. katzo	katsho	bisyllabic
4. phend vs. phedni vs. phendi	phendi	bisyllabic
5. tyhiphive vs. thyiphive vs. tydliphive	tyhiphive	trisyllabic
6. dwasepe vs. wasepe vs. watshepe	wasepe	trisyllabic
7. belezwi vs. belezywi vs. nbelezwi	belezwi	trisyllabic
8. omdawo vs. ondawo vs. ondwawo	ondawo	trisyllabic
9. dlenqhwolaba vs. dlenqhwrolaba vs. dlenrhoqhwoba	dlenqhwolaba	quad-syllabic
10. ndodxelecha vs. ndoxelecha vs. ndodyhalecha	ndoxelecha	quad-syllabic
11. cwalabane vs. mcwalabane vs. cxwalabane	cwalabane	quad-syllabic
12. intshwalena vs. intchwalena vs. inthcwalena	intshwalena	quad-syllabic

3.4.2.2.1 Task administration and scoring

Similar to the word specific orthographic knowledge task, this task was administered on a one-on-one basis by trained isiXhosa home language research assistants. The task took approximately five minutes per learner. It was presented visually on A4 pages with each task stimuli printed in large readable font. The research assistants were instructed not to read the stimulus words aloud to the learner. The research assistants told the learners to point to the word that resembled a real isiXhosa word, or that resembled a word they might find in an isiXhosa book. The research assistants then indicated on their marking sheets (included in [Appendix 5](#)) what word the learner pointed to. If the learner chose the correct word, they received a score of 1, and if they chose the incorrect word, they received a score of 0. They were first given two practice examples to complete with the research assistants to assist with their understanding of how to complete the task before attempting the actual task. The learners were given no corrective feedback.

3.4.2.3 Spelling task

3.4.2.3.1 Task development

The spelling task used in this thesis was taken from Daries and Probert (2020). The task was specifically designed for spelling error analysis, and thus there were a number of decisions that were taken into account for post task analysis in the study. These were: frequency, word length in syllables, grapheme complexity, and word type (Daries & Probert, 2020). Frequency referred to whether or not the learners had or might have encountered the words before. With this consideration in mind, the real words had been sourced from the list of 300 top high frequency words in isiXhosa compiled by Rees and Randerla (2017). Words were chosen at different frequency levels to provide an appropriate range of real words. These were not the same words as those used in the word specific orthographic knowledge task. In terms of word length in syllables and grapheme complexity, the words ranged in syllables per word and in the number of complex graphemes per word. Further, to ensure that the task was fair and appropriate, all the real words chosen had no morphological intricacy and thus only had lexical meanings. All of these decisions were taken into account for the real word spelling task (Daries & Probert, 2010). For the current study, four words were replaced from the Daries and Probert (2020) task with different real words which still met the above linguistic decisions: *oku* was replaced with *umntu*, *kwaye* with *kodwa*, *amanzi* with *amehlo*, and *amabali* with *ngokwenene*. Learners scored the highest on these words in the original task as they were included as examples of

words with no complexity. These words were replaced in the current thesis in order to enhance the complexity of the task as minor ceiling effects were found in the Davies and Probert (2020) task. The list of real words used in the spelling task can be seen in Table 5 below. The decisions as discussed above are also illustrated in Table 5 below.

3.4.2.3.2 Task administration and scoring

This task was administered in groups by trained isiXhosa home language research assistants and took approximately 15 minutes per group. The spelling task consisted of 12 items. The research assistant said the words out loud individually and then repeated the words once more. The learners therefore heard the words twice before being expected to write them down. Once the spelling task was completed, the tasks were scored on a binary scale based on whether learners spelled the word correctly or not, i.e., 1 for correct and 0 for incorrect. These results were used in later analysis.

Table 5: Spelling task

Task item	English translation	Word length	Grapheme complexity	Frequency
1. umntu	person	bisyllabic	<mnt> - consonant blend	38
2. kodwa	but	bisyllabic	<dw> - digraph	4
3. lwakhe	his	bisyllabic	<lw> – consonant blend <kh> – aspirated digraph	102
4. phandle	outside	bisyllabic	<ndl> – consonant blend <ph> – aspirated digraph	204
5. amehlo	eyes	tri- syllabic	<hl> - digraph	118
6. kuqala	first	tri- syllabic	<q> - click	199
7. ixesha	time	tri- syllabic	<x> - click <sh> – aspirated digraph	90
8. namhlanje	today	tri- syllabic	<mhl> – consonant blend <nj> – consonant blend	91
9. ngokwenene	really	quad- syllabic	<ng> - digraph <kw> - digraph	251
10. umakhulu	grandmother	quad- syllabic	<kh> – aspirated digraph	46
11. amaqanda	eggs	quad- syllabic	<q> –click <nd> – consonant blend	262
12. ngaphakathi	inside	quad- syllabic	<kh> and <th> – aspirated digraph <ng> – diagraph	175

3.4.2.4 Oral reading fluency

This task is taken from the Early Grade Reading Assessments (EGRA) (DBE, 2021), and thus is considered a standardized measure. The EGRA is one of the most widely used literacy measurement tools in the developing world; which supports their use as opposed to designing a specific measure for the study (Piper & Zuilkowski, 2016). This task required the participants to read a story aloud for one minute. The errors made during the task were recorded by the research assistants and subtracted from the total words read by the learner to provide a words correct per minute (WCPM) score. Errors included: the incorrect reading of a word, mispronunciations, and words skipped by the learner. This score was then used as an overall reading fluency measure (Schaefer & Kotze, 2019; Spaul et al., 2020). This task was administered on a one-on-one basis by trained isiXhosa home language research assistants.

The reading passage used was entitled *Uhobe noMbovane (Ant and Dove)*. The story was 72 words long with a mean of 5.1 words per sentence, and 7.8 letters per orthographic word. The reading passage is provided in [Appendix 6](#).

3.4.2.5 Phonological awareness task

3.4.2.5.1 Task development

The PA task used for this thesis is taken from the EGRA for grade 3 isiXhosa learners and thus was appropriate for use in the current study (DBE, 2021). However, adaptations were made to the original EGRA PA task to ensure there was equal distribution in the manipulation of sound units (phonemes and syllables) in the task while still keeping the structure of the original EGRA task. The following section discusses the task structure as well the linguistically informed decisions which were made to ensure that the task was appropriate for the assessment of grade 3 PA.

The task required the identification and manipulation of phonemes and syllables in real isiXhosa words. The original task included the identification, deletion and substitution of phonemes and syllables in real isiXhosa words. However, the number of task items per subtask was not equal, and thus the task was adapted to include only the identification and deletion of phonemes and syllables in isiXhosa real words with an equal number of task items per subtask. This meant that there were four subtasks in total: phoneme identification, syllable identification, phoneme deletion, and syllable deletion.

Phonemes and syllables were used as the literature attests to their importance for phonological decoding in Southern Bantu languages (Wilsenach, 2013; Diemer *et al.*, 2015; Wilsenach, 2019). This is mainly because of the open CV (consonant – vowel) syllable structure of isiXhosa. Syllables are theoretically more noticeable than phonemes, and existing research indeed suggests that syllable awareness might be better developed than phoneme awareness in Southern Bantu languages (Diemer *et al.*, 2015; Wilsenach, 2013; Probert, 2019). Further, phonemes were included as they have long been understood as an important sound unit for reading in both international research and national research on African languages (Adams, 1990; Diemer *et al.*, 2015; Wilsenach, 2019). While onset and rime are also linguistic sound units of PA, they were not included, because, as mentioned above, isiXhosa has an open syllable structure, thus there are no closed syllables (Diemer, 2015).

The real words used for this task were mainly taken from the original EGRA PA task with some additional real words included which were sourced from the list of 300 high frequency words in isiXhosa compiled by Rees and Randera (2017). The words chosen from the list of 300 high frequency words were purposively chosen to have minimal morphological complexity and also to not include any of the same real words used in the other tasks in the study. Further, these words ranged in word length in syllables, with both bisyllabic and trisyllabic words used. There are relatively few monosyllabic words in isiXhosa, and thus monosyllabic words were not included in the task. Further, learners were required to identify phonemes and syllables and delete phonemes and syllables from the initial, medial and final word position to provide a range in complexity. However, because of the CV (consonant – vowel) syllable structure of isiXhosa, learners were only able to delete phonemes from the initial word position. In addition, the real words used also ranged in grapheme complexity with some words containing complex graphemes.

In total, there were 12 task items, with three phoneme identification items, three syllable identification items, three phoneme deletion items, and three syllable deletion items. A list of these task items and the instructions to the learner, which was translated to isiXhosa for the actual task, are shown in Table 6 below.

3.4.2.5.2 Task administration and scoring

The learners were verbally presented with 12 task items and the research assistants used the participants' names to help explain how to complete the task before starting. Thus, the research

assistants showed the learners how to identify and delete phonemes and syllables in their names. The task was administered orally on an individual basis by trained isiXhosa home language research assistants and took approximately five minutes per learner.

The phoneme and syllable identification tasks involved learners orally identifying specific phonemes and syllables in a variety of isiXhosa real words. For example, the research assistants asked the learners to identify the first phoneme in the word *bona*. The correct answer would be /b/. For the phoneme and syllable deletion tasks, learners were required to remove specific phonemes and syllables from isiXhosa real words and then to state orally the real word without the phoneme or syllable. For example, learners were asked to remove the /ya/ from the real word *yatsho* with the correct answer being ‘tsho’.

Table 6: Phonological awareness task

Item	Real word	Instruction to learner	Correct answer
Phoneme Identification			
1.	hleka	Say the first sound in the word in the word hleka	/hl/
2.	bona	Say the second sound in the word bona	/o/
3.	kuqala	Say the last sound in the word kuqala	/a/
Phoneme Deletion			
4.	vuka	Say the word vuka without /v/	uka
5.	kodwa	Say the word kodwa without /k/	odwa
6.	umfundi	Say the word umfundi without /f/	umundi
Syllable Identification			
7.	ngathi	Say the first sound in the word in the word ngathi	/nga/
8.	kwafika	Say the second sound in the word kwafika	/fi/
9.	abahlobo	Say the last sound in the word abahlobo	/bo/
Syllable Deletion			
10.	yatsho	Say the word vuka without /ya/	tsho
11.	ngaphandle	Say the word kodwa without /ndle/	ngapha
12.	kufanele	Say the word umfundi without /ku/	fanlele

A total score for PA was used from the combined score from each of the task items which were given a score of 1 for a correct answer and a score of 0 for an incorrect answer. This summed score for PA was used for later analysis. The research assistants recorded the learners' responses on the marking sheet included in [Appendix 7](#). The learners were given no corrective feedback; their answers were only acknowledged by the research assistant as a means to indicate that they could continue to the next stimulus item.

3.4.2.6 Rapid automatized naming

The RAN tasks used for this thesis were taken from the EGRA for grade 3 isiXhosa learners, and thus were appropriate for use in the current study (DBE, 2021). According to the task designer, Maxine Schaefer, the decision to not include RAN digits and RAN colours was made due to inconsistencies which arose during her doctoral studies which ultimately informed the design of the RAN tasks for the EGRA. Due to bilingualism amongst the participating learners, inconsistencies arose with the naming of digits and colours homogeneously despite correction and thus it was the decision to only include objects and letters (M. Schaefer, personal communication, August, 22, 2022).

Participants were required to name verbally 36 letters and items in isiXhosa as rapidly as possible in an alphanumeric and non-alphanumeric RAN tasks. For the alphanumeric RAN task, the letters were presented to the participants on a sheet of paper as seen in Figure 6 below. These letters were all lower case letters and included no complex graphemes. For the non-alphanumeric RAN task, 36 items were presented to the learners as seen in Figure 7 below.

In this study each participant was allocated as much time as needed to complete the task. The time taken to complete the task and letters/items incorrectly named were recorded on a marking sheet by research assistants. The number of incorrectly named letters/items were then subtracted from the total number of letters/items named, and then this number was divided into the time taken by the learner to complete a task in seconds to provide a letters/items correct per second (LCPS and ICPS) score used for later analysis. The marking and instruction sheets used for both the RAN item and letter-naming tasks are included in [Appendix 8](#).

Both the item and letter-naming tasks were administered orally by isiXhosa home language research assistants. Before the administration of the tasks, learners were given an explanation of how to complete the task, as well as a brief practice round with the letters and items used in the actual tasks. These tasks took, on average, 20 – 120 seconds per learner.

o t a e b l t o l
 b a e l b t a e o
 t b l o e a t l e
 b a o e l b o t a

Figure 6: RAN letter-naming task.



Figure 7: RAN item-naming task.

3.4.2.7 Letter-sound knowledge

The letter-sound knowledge task was also taken from the grade 3 isiXhosa EGRA (DBE, 2021). This task required the learners to read aloud as many letters as possible in one minute, with the errors made when reading the letters noted. There were a total of 110 letters on a sheet

of A4 paper presented in medium-sized readable font to the learners. The total number of errors made in the one minute was then subtracted from the total number of letters read to provide a letters correct per minute (LCPM) score which was used for later analysis. The marking sheet used by the research assistants is included in [Appendix 9](#). There were five practice items used which the research assistants went through with learners to make sure that they understood how to complete the task. Figure 8 below illustrates the visual cues provided to learners for the letter-sound knowledge task.

S	v	n	g	L	y	Z	h	W	m
k	th	G	b	c	hl	i	d	z	a
p	nd	z	U	ng	sh	j	kh	X	u
g	sw	B	qh	i	f	e	Z	R	I
S	n	lw	ndl	t	Y	ts	bh	nc	E
y	tsh	Q	ph	M	v	O	t	ny	P
dl	A	e	mp	f	ph	h	u	A	r
W	dw	H	b	nz	g	dl	m	hl	q
L	o	lw	a	X	ntl	E	ny	p	x
N	kw	nc	D	ndl	y	mb	j	C	mv
V	ncw	W	q	V	h	ndl	q	tsh	y

Figure 8: Letter-sound knowledge task

3.4.3 Procedures

In total, eight tasks were administered with the learners. These were: word specific orthographic knowledge, general orthographic knowledge, spelling, ORF, letter-sound knowledge, RAN item and letter-naming and PA. All tasks, except the spelling task, were conducted on a one-to-one basis between a research assistant and a learner. The word specific and general orthographic knowledge tasks were administered first, and the remaining tasks were assessed after in the following order: RAN item and letter-naming, PA, and then the ORF task. As the spelling task was group administered, it was conducted last. All testing was done in isiXhosa. Each school has a literacy centre which is a separate room where literacy intervention activities take place, and this is where the testing was performed. In each centre there were five stations: one for each of the tasks conducted on an individual basis, and the learners rotated between these five stations. Once the tasks were completed, the learners were given a sticker in appreciation of their participation in the study. All responses and post task scoring were captured by the research assistants on an assessment marking sheet and later transferred onto excel spreadsheets for data analysis using R version 4.04 (2021).

3.4.4 Data coding and analysis

Combined scores for the word specific and general orthographic knowledge tasks were used, which included the total number of items correctly completed out of 12. This was also done for spelling task. A composite score was used for phoneme and syllable awareness which was combined to create an overall score of PA. For the ORF task, a WCPM was used for analysis and for the letter-sound knowledge task, a LCPM score was used. For the RAN item and letter-naming tasks, a ICPS and LCPS score was used for later analysis.

The data was analysed statistically using R version 4.04 (2021). All data from the measures used were analysed for normality, and the data from the word specific orthographic knowledge, general orthographic knowledge, PA, and spelling tasks were analysed for reliability. Further, descriptive statistics were performed providing an overview of the results per task.

The following inferential statistical analyses were conducted: a t-test was performed to assess the statistical difference between variables. In particular, whether there was a statistically significant difference in the results of the word specific and general orthographic knowledge tasks. In addition, correlation analyses were conducted to investigate the strength of the relationship between the word specific and general orthographic knowledge, ORF, spelling, RAN, letter-sound knowledge, and PA. Moreover, multiple general linear regression analyses were conducted. The regression models included word specific and general orthographic knowledge as respective outcome variables with PA, RAN item and letter naming and letter-sound knowledge as predictors. In addition, spelling and reading, as measured by ORF, were included as outcome variables in respective regression models with word specific and general orthographic knowledge, letter-sound knowledge, PA and RAN item and letter naming as predictor variables in both models. Lastly, quantile linear regression analyses were performed to assess whether the relationships in the two above-mentioned models were dependent on overall reading and spelling ability.

3.4.5 Conclusion

The method used for the current investigation of orthographic knowledge in isiXhosa and its relation to phonological processing, letter-sound knowledge, reading, and spelling was detailed in this chapter. The chapter covers the study design, ethical clearance and consent procedures as well as describes the participants and schooling context. Further, the chapter was divided

into two sections: the pilot phase and the main data collection phase. For both sections, a detailed discussion of the task development and task administration and scoring for each of the eight measures in the thesis were discussed. Finally, the procedures and information regarding data coding and analysis were presented.

CHAPTER 4: RESULTS

4.1 Introduction

This chapter provides the quantitative results from the data analysis performed for this thesis in order to answer the main research questions. The chapter is divided into two sections. The first section ([section 4.2](#)) provides an overview of the results. This section provides the descriptive results for the word specific and general orthographic knowledge tasks in order to answer research question one. In addition, results of a T-test conducted are also presented as an examination of the difference in the learner performance on word specific and general orthographic knowledge tasks. Included in this section are the descriptive statistics for the additional metalinguistic skills of interest in the thesis, namely, RAN (item and letter-naming), PA, letter-sound knowledge, oral reading fluency (ORF) and spelling.

The second section ([section 4.3](#)) provides the inferential statistical data analyses which pertain to research questions two and three. Firstly, this section presents the results from a Pearson's correlation matrix inclusive of all the variables of interest in the study in order to assess the strength and direction of these relationships. In particular, the significant relationships between word specific and general orthographic knowledge, and the remaining variables of interest, are outlined. This is followed by the results of multiple general linear regressions that reflect the contribution of RAN, letter-sound knowledge and PA to word specific and general orthographic knowledge respectively in order to address research question two.

Lastly, reading (as measured by ORF) and spelling are included as outcome variables in respective multiple general linear regression models to evaluate the unique contribution of word specific orthographic knowledge, general orthographic knowledge, RAN, letter-sound knowledge and PA to these outcome variables. In addition, quantile linear regressions are included to complement the aforementioned analyses by looking at whether the contribution of the above-mentioned covariates is dependent on learners' respective reading and spelling ability levels. The Rmarkdown of the data analysis is available for review in [Appendix 10](#).

Research question four deals with the interpretation of the results from research question three. Thus, this question will be answered qualitatively drawing from the findings of research question three in Chapter 5 ([Discussion](#)).

4.2 Overview of results

The following section provides an overview of the results. The descriptive statistics for each of the eight tasks (word specific orthographic knowledge, general orthographic knowledge, RAN (item and letter-naming), letter-sound knowledge, PA, ORF, and spelling) are presented in Table 7 below and are mainly discussed in this section. In particular, the table illustrates the distribution of data (mean), the spread of the values (standard deviation), as well the dispersion of data (skewness and kurtosis), the normality of the data (Kolmogorov-Smirnov normality test), the percentiles (24th, 50th, 75th) and the percentage of zero scores for each of the tasks.

This section will unpack the descriptives that are presented in Table 7 below, as well as the results from Cronbach alpha reliability statistical analyses of the non-timed constrained tasks i.e., word specific orthographic knowledge, general orthographic knowledge, PA and spelling. The descriptives from the orthographic knowledge tasks are described first ([section 4.2.1](#)) as it is the skill of primary focus in the study, and will therefore be addressed with the greatest detail in order to answer research question 1. Further, the results of the t-test conducted are presented which establishes whether there is a statistically significant difference in the results of the word specific and general orthographic knowledge tasks. Thereafter, the additional metalinguistic skills of interest will be outlined.

As outlined in [Chapter 3](#), 140 grade 3 learners were assessed in the study, all of whom were first language isiXhosa speakers instructed in isiXhosa at their respective schools. Participants from five schools were assessed and more than half the sample were female (N=74, 53%), with 47% of the sample being male (N=66). The average age was 8.42 years old.

4.2.1 Orthographic knowledge

For the word specific orthographic knowledge task, the average was 57.5% (M=6.9, SD=3.4), and for the general orthographic knowledge task, the average was 58.3% (M=7, SD=2.7). The learners thus performed similarly on both tasks, but they did marginally better on the general orthographic knowledge task than the word specific orthographic knowledge task.

To assess whether this difference in performance was a statistically significant difference, a paired sample t-test was conducted. A Student's paired sample t-test showed that there was no statistically significant difference in the performance on the word specific and general

orthographic knowledge tasks, $t=0.49$, $df=139$, $p > 0.05$, 95% CI=[-0.57;0.34], Cohen's $d=0.04$.

Figures 9 and 10 below present density plots of the distribution of the data for the word specific and general orthographic knowledge tasks. The dotted red line represents the mean for each of the figures in this section, while the solid red line reflects the standard deviation. As illustrated in Figure 9 and confirmed by a Kolmogorov-Smirnov normality test, the word specific orthographic knowledge task data does not follow a normal distribution ($M=6.9$, Median=7, $d=0.93$, $p<0.05$). Similarly, for the general orthographic knowledge task, a non-normal distribution of the data is evident ($M=7$, Median=7, $d=0.96$, $p<0.05$). The density plots also illustrate that there were not many learners who scored in the lower quartile (0.1) for both the word specific and general orthographic knowledge tasks. This is supported by the low percentage of 0 scores for both tasks (2.9% and 0% respectively).

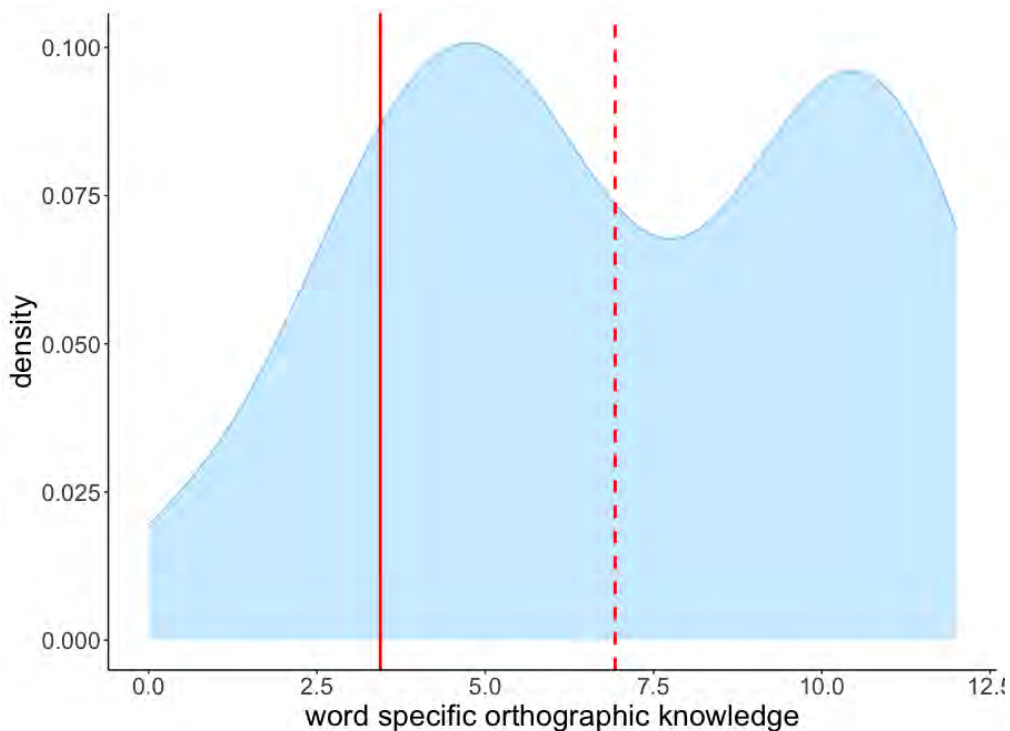


Figure 9: Density plot- Word specific orthographic knowledge

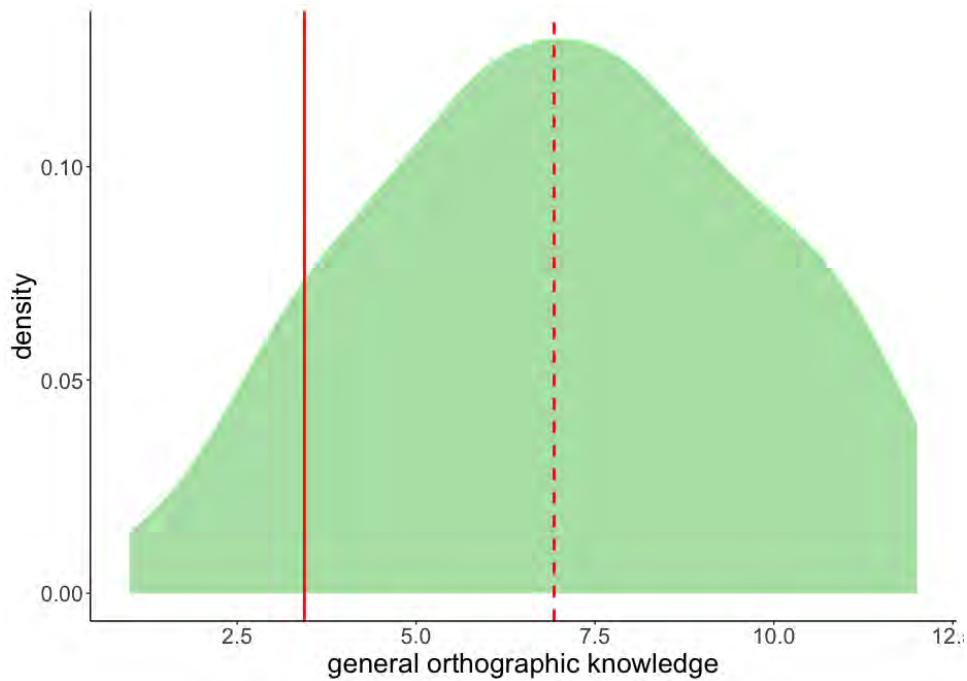


Figure 10: Density plot - General orthographic knowledge

The word specific and general orthographic tasks were designed specifically for this study and have consequently never been administered before. Therefore, Cronbach alpha analyses of internal consistency were conducted for each of these tasks. The internal consistency for the word specific orthographic knowledge task was 0.84 indicating that the task was very reliable (Rosenthal & Rosnow, 1991). Despite the adaptations made for main data collection, the reliability of the general orthographic knowledge remained on the lower to moderate end indicating that further revision to this task needs to be made ($\alpha=0.65$). The output of the general orthographic knowledge reliability analysis revealed that some items were negatively correlated with the total scale, and thus these items should be reversed and most likely need revision, in particular item five.

Table 7: Descriptives statistics (N=140) for word specific orthographic knowledge, general orthographic knowledge, RAN (item and letter-naming), PA, ORF, spelling and letter-sound knowledge

	Mean	Min	Max	SD	Kolmogorov-Smirnov	Skewness	Kurtosis	25 th Percentile	50 th Percentile	75 th Percentile	% zero scores
Word specific orthographic knowledge (/12)	6.9	0	12	3.4	d=0.93 p<0.05	-0.1	-1.2	4	7	10	2.9
General orthographic knowledge (/12)	7	1	12	2.7	d= 0.96 p<0.05	-0.1	-0.8	5	7	9	0
RAN: letter-naming (LCPS)	0.9	0.1	2.6	0.5	d= 0.60 p<0.05	0.8	0.3	0.58	0.86	1.2	0
RAN: item-naming (ICPS)	0.7	0.3	2.2	0.2	d=0.63 p< 0.05	2.3	12.5	0.6	0.7	0.82	0
Phonological awareness (/12)	5.4	0	12	2.9	d= 0.89 p< 0.05	0.2	-0.8	3	5	8	2.9
Oral reading fluency (WCPM)	13	0	62	13.3	d= 0.66 p<0.05	0.9	0.3	0	10.5	22	30
Spelling (/12)	5.6	0	12	4.4	d=0.70 p<0.05	0	-1.5	1	6	10	21.4
Letter-sound knowledge (LCPM)	38.4	0	97	21.1	d=1 p< 0.05	0.4	-0.3	21.75	37.5	52	0.7

Note: WCPM = words correct per minute; SD= standard deviation; LCPM – letters correct per minute; LCPS – letters correct per second; ICPS – items correct per second

4.2.2 Rapid automatized naming

Results from the RAN tasks reveal that participants could identify, on average, 0.9 LCPS ($M=0.9$, $SD=0.5$), and 0.7 ICPS ($M=0.7$, $SD=0.2$). Figures 11 and 12 present density plots of the distribution of the data for the RAN letter-naming ($M=0.9$, Median=0.9, $d=0.60$, $p<0.05$) and item-naming ($M=0.7$, Median=0.7, $d=0.63$, $p<0.05$) tasks. These figures indicate that for both tasks, the data was skewed to the right with a non-normal distribution.

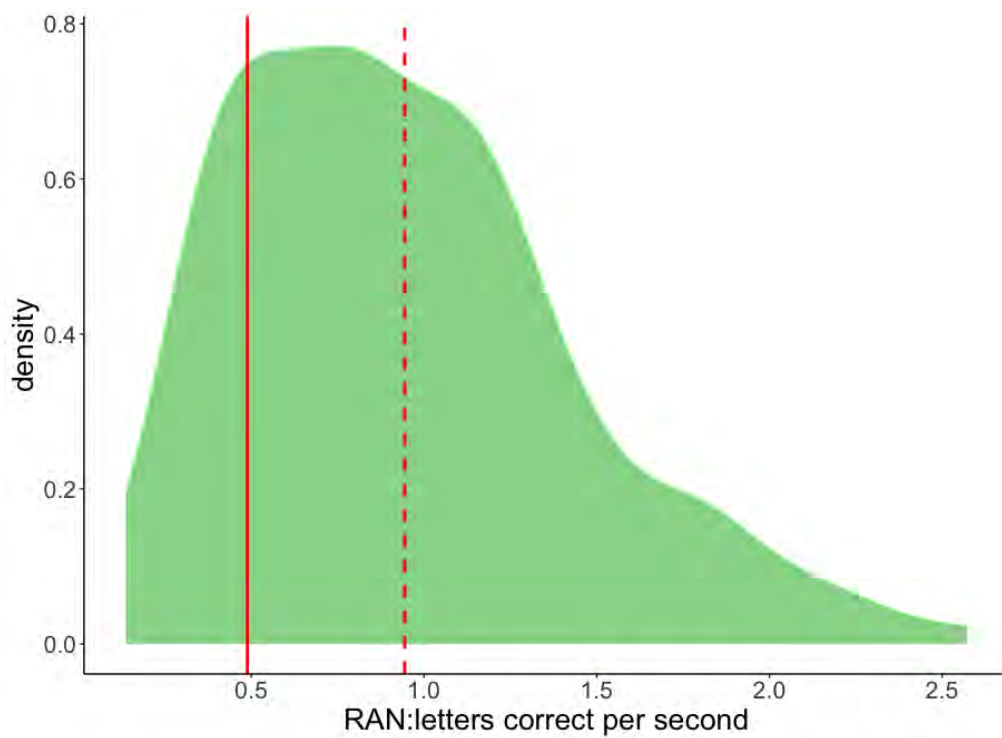


Figure 11: Density plot - Rapid automatized letter-naming (LCPS)

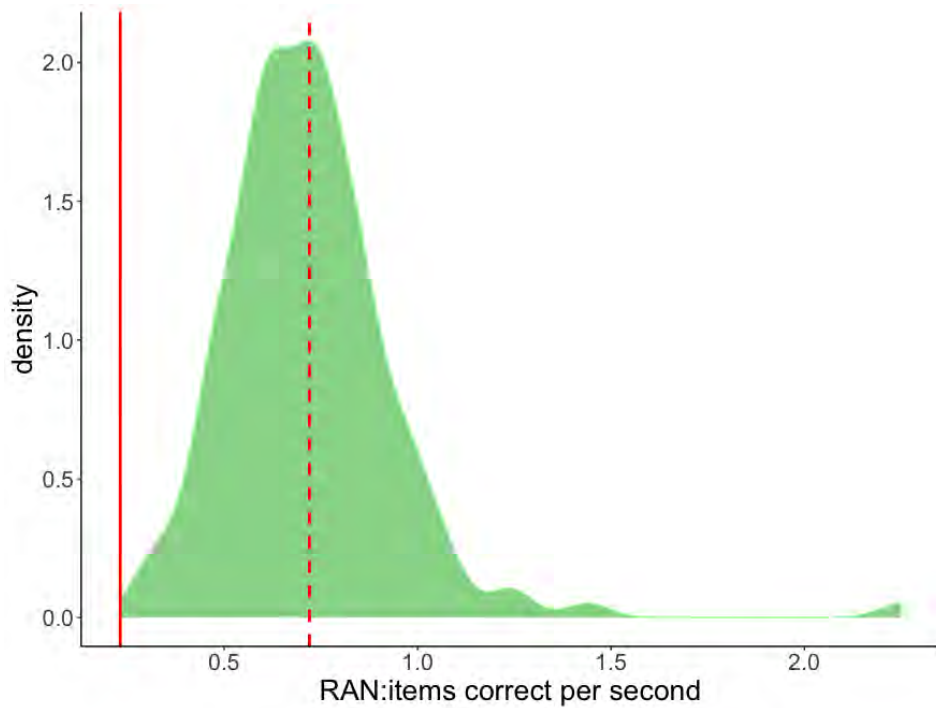


Figure 12: Density plot – Rapid automatized item-naming (ICPS)

4.2.3 Phonological awareness

The results reveal that these grade 3 learners scored an average of 45% (M=5.4, SD=2.9) on the PA task. As seen in the density plot for PA in Figure 13, the data was slightly skewed to the right with a non-normal distribution (M=5.4, Median=5, d=0.89, $p < 0.05$).

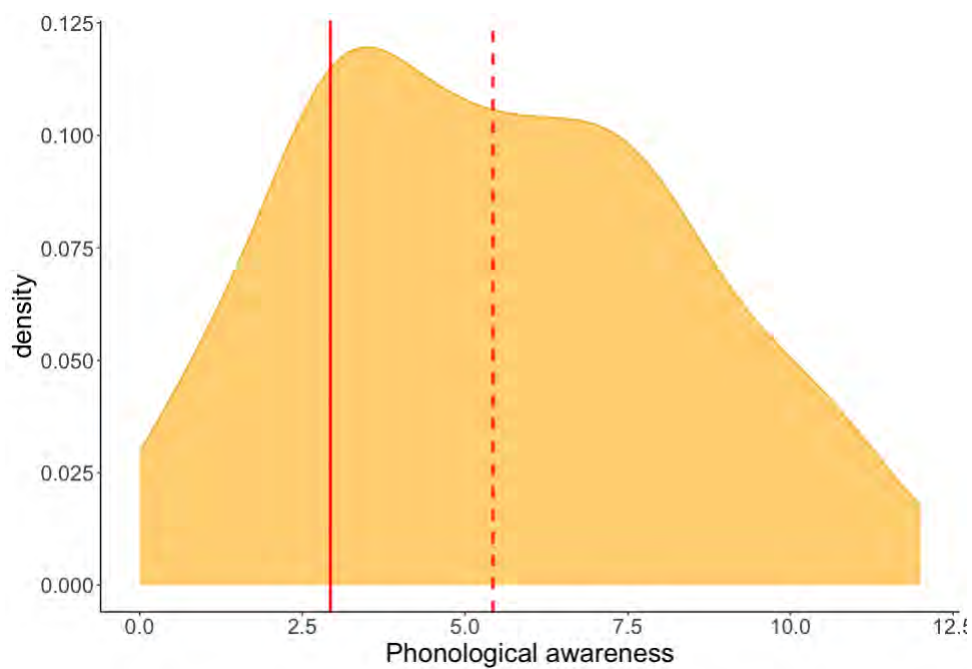


Figure 13: Density plot – Phonological awareness

As noted in [Chapter 3](#), the PA task used in this study was adapted from the EGRA PA subtask (DBE, 2021). As such, a Cronbach’s alpha reliability analysis was conducted to assess the internal consistency of this measure. The task was found to be a reliable measure ($\alpha=0.75$) (Rosenthal & Rosnow, 1991).

4.2.4 Oral reading fluency

The grade 3 learners in this sample were able to read 13 WCPM ($M=13$, $SD=13.3$) on average. The learners were categorised into reading fluency groups using the suggested isiXhosa fluency benchmarks ⁴ for children in grade 3 (Ardington *et al.*, 2021).

Table 8: Number and proportion of participants per ORF category

Category	n (%)
0 WCPM	42 (30)
1-19 WCPM	56 (40)
20-34 WCPM	30 (21.4)
35 or more WCPM	12 (8.6)

As indicated in Table 8 above, 98 learners (70%) are not reading at the grade 2 lower fluency threshold of 20 WCPM, with 30 learners (21.4%) reading within the fluency zone of 20-34 WCPM. Twelve learners are reading above the upper threshold of 35 or more WCPM. These results indicate that this sample of grade 3 learners are predominantly poor readers. Figure 14 shows a density plot for the ORF data. The plot reflects a floor effect in the data as it is skewed to the right with a non-normal distribution ($d=0.66$, $p<0.05$).

⁴ Benchmarks and thresholds are representative of levels of proficiency that learners are expected to reach for specific literacy skills. Ardington *et al.* (2021) outlines grade 1 and 3 benchmarks and a grade 2 threshold for learners learning in Nguni languages. A minimum of 40 LCPM is set as the grade 1 letter-sound knowledge benchmark. An ORF threshold of 20 WCPM is set for grade 2 learners and ORF benchmark of 35 WCPM is set for grade 3 learners. Ardington *et al.* (2021) states that if these benchmarks and threshold are not reached, learners will struggle with higher order reading skills, for example, oral comprehension.

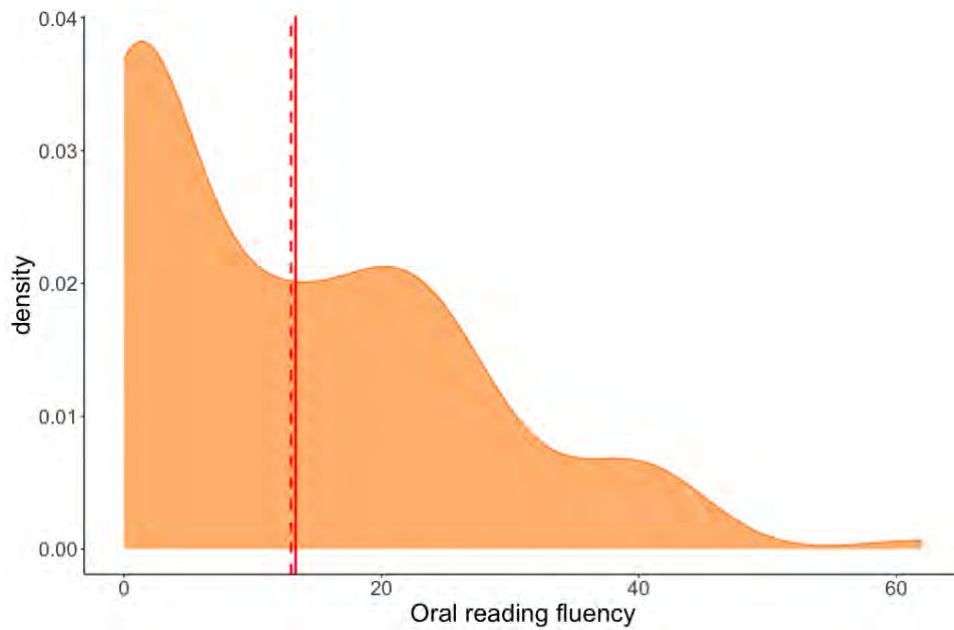


Figure 14: Density plot - ORF (WCPM)

4.2.5 Spelling

For the spelling task, the grade 3 learners in this sample could spell on average 5.6 words correctly out of a possible 12 words attempted ($M=5.6$ (46.6%), $SD=4.4$). A density plot for spelling is presented in Figure 15 below, and shows that the data had a non-normal distribution ($M=5.6$, Median=6, $d=0.70$, $p<0.05$).

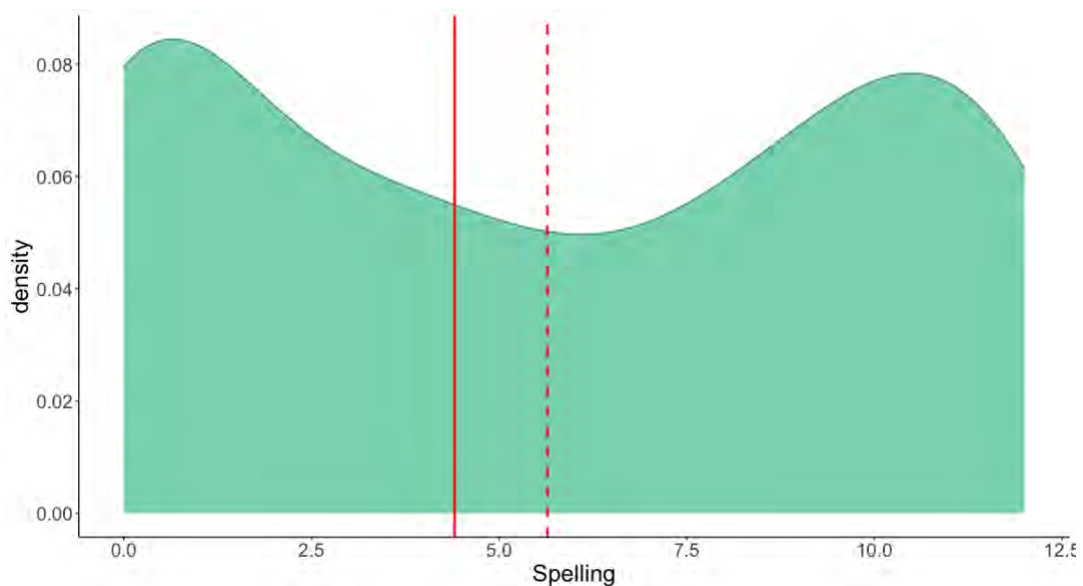


Figure 15: Density plot- Spelling

The spelling task was specifically adapted from my Honours research (as reported in Davies & Probert, 2020) for use in this thesis, thus, a Cronbach Alpha reliability statistical analysis was conducted to assess the internal consistency of the spelling measure. The analysis output

revealed the spelling task to be a highly reliable measure ($\alpha=0.93$) (Rosenthal & Rosnow, 1991).

4.2.6 Letter-sound knowledge

For this sample of grade 3 learners, the average LCPM score was 38.4 (M=38.4, SD=21.1). Figure 16 below illustrates that the data was not normally distributed (M=38.4, Median=37.5, $d=1$, $p<0.05$).

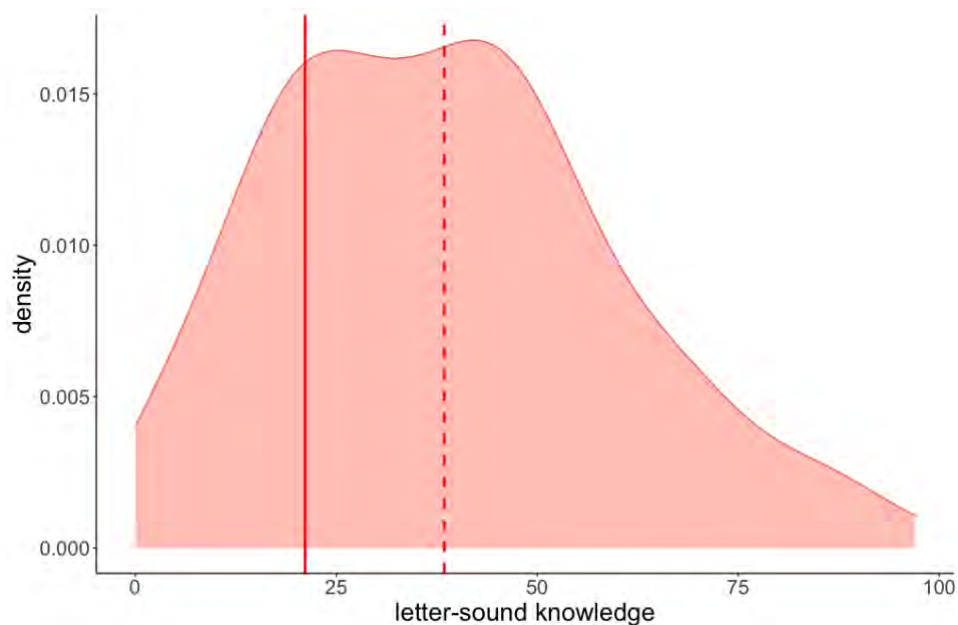


Figure 16: Density plot - Letter-sound knowledge (LCPM)

4.3 Inferential statistics

This section provides the results from inferential statistical analyses of the data, excluding the t-tests which were reported on in the previous section. The results are presented in succession of research questions two and three.

4.3.1 Correlation matrix

Table 9 presents a Pearson's correlation matrix representing the strength and direction of the relationships between the variables of interest in this study (word specific orthographic knowledge, general orthographic knowledge, RAN (item and letter-naming), letter-sound knowledge, PA, ORF and spelling). As orthographic knowledge is the focus of the analysis,

only the significant relationships evident between orthographic knowledge (word specific and general) and the additional variables of interest will be discussed.

Table 9 below shows that word specific orthographic knowledge has significant relationships with all of the variables with the strongest relationships evident between word specific orthographic knowledge and letter-sound knowledge ($r=0.75$ CI [6.62, 0.81]), ORF ($r=0.73$ CI [6.47, 0.8]) and spelling ($r=0.75$ CI [6.73, 0.82]). These results present evidence for the convergent validity of the word specific orthographic knowledge instrument as it is highly correlated with similar variables such as letter-sound knowledge and spelling (Golafshani, 2003).

General orthographic knowledge displays weak to moderate and significant relationships with all variables except RAN (item-naming). This provides further evidence for the need for revisions to the general orthographic knowledge task. No multicollinearity between variables is evident.

The correlation matrix indicates the statistical association of the variables to word specific and general orthographic knowledge respectively; however, to explore the predictive relationships between orthographic knowledge (word specific and general) and the variables of interest in the study further, multiple general linear regressions were conducted.

4.3.2 Multiple general linear regressions

This section begins by presenting the results from multiple general linear regressions which examine the extent to which PA, RAN (item and letter-naming), and letter-sound knowledge predict word specific and general orthographic knowledge respectively in order to answer comprehensively research question two.

This is followed by two multiple general linear regression models. The first considers reading (as measured by ORF) as the outcome variable and the second looks at spelling as the outcome variable. The covariates in both models are word specific orthographic knowledge, general orthographic knowledge, RAN (item and letter-naming), letter-sound knowledge and PA. In addition, quantile linear regressions are included to complement the aforementioned analyses by looking at whether the contribution of the above-mentioned covariates is dependent on learners' respective reading and spelling ability levels in an effort to answer question three. For

the subsequent analyses, the scores for each of the variables were transformed to z scores (mean of 0 and standard deviation of 1) to account for the variation in the scales used for each of the tasks (Winter, 2020).

Table 9: Pearson's correlation coefficients for word specific orthographic knowledge, general orthographic knowledge, PA , letter-sound knowledge, RAN-item and letter naming, spelling and ORF

Variables	1.	2.	3.	4.	5.	6.	7.
1. Word specific orthographic knowledge							
2. General orthographic knowledge	0.63**						
3. Phonological awareness	0.62**	0.5**					
4. Letter-sound knowledge	0.75**	0.6**	0.61**				
5. Oral reading fluency	0.73**	0.61**	0.56**	0.78**			
6. Spelling	0.75**	0.53**	0.5**	0.78**	0.78**		
7. RAN: Letter-naming	0.51**	0.35**	0.23**	0.55**	0.6**	0.51**	
8. RAN: Item-naming	0.24*	0.09	0.17*	0.23*	0.33**	0.23*	0.39***

All significant correlation indicated as p<0.05* p<0.001**

4.3.2.1 Predictors of word specific orthographic knowledge

Table 10 provides the results from a multiple general linear regression for which word specific orthographic knowledge was the dependent (outcome) variable and PA, letter-sound knowledge and RAN were the independent (predictor) variables.

An assessment of the model diagnostics revealed that there were no violations of the assumptions of normality (see Normal Q-Q plot), linearity (see Residuals vs Fitted plot), and homoscedasticity of residuals (see Scale-Location plot) as shown in Figure 17. Further, there are no influential observations evident (see Residuals vs Leverage plot) (Kassambara, 2018).

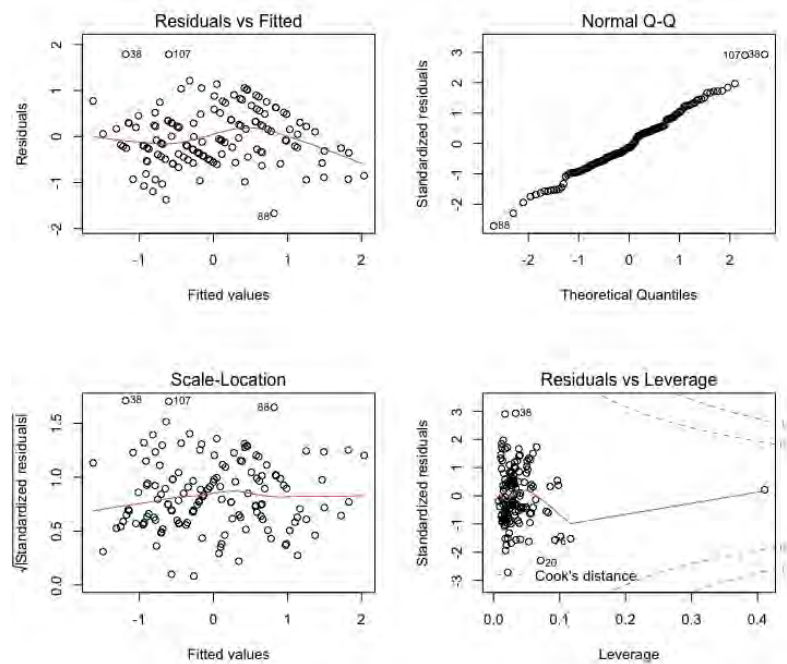


Figure 17: Diagnostic plots – predictors of word specific orthographic knowledge

The overall regression model was significant, $F(4,135)=56.35, p<.001$. Together the variables explained 61% of the variance (adjusted $R^2=0.61$) in word specific orthographic knowledge. However, only letter-sound knowledge, PA and RAN (letter-naming) were significant predictors, with letter-sound knowledge making the largest contribution ($\beta=0.46$), followed by PA ($\beta=0.3$).

Table 10: Multiple general linear regression – word specific orthographic knowledge predicted by letter-sound knowledge, PA and RAN

Predicted variable: Word specific orthographic knowledge			95% Confidence Interval		
Predictors	SE	β	Lower	Upper	t
(Intercept)	0.05	-0.0	-0.10	0.10	0
Letter-sound knowledge	0.08	0.46**	0.31	0.62	5.97
PA	0.07	0.3**	0.17	0.43	4.44
RAN: item-naming	0.06	0.01	-0.11	0.12	0.15
RAN: letter-naming	0.07	0.18*	0.05	0.31	2.67

*p < .05, ** p < .001 SE = standard error

The results presented in Table 10 above are illustrated in the dot and whisker plot below (Figure 18). The dot represents the point estimate and the 95% confidence interval is represented by the whiskers for each of the variables. Variables to the right of the dotted line represent those variables which significantly predicted word specific orthographic knowledge and those which touch the dotted line or are indicated to the left of the dotted line were not significant predictors of word specific orthographic knowledge. The same interpretation applies for each of the dot and whisker plots presented in this section (Solt & Hu, 2021).

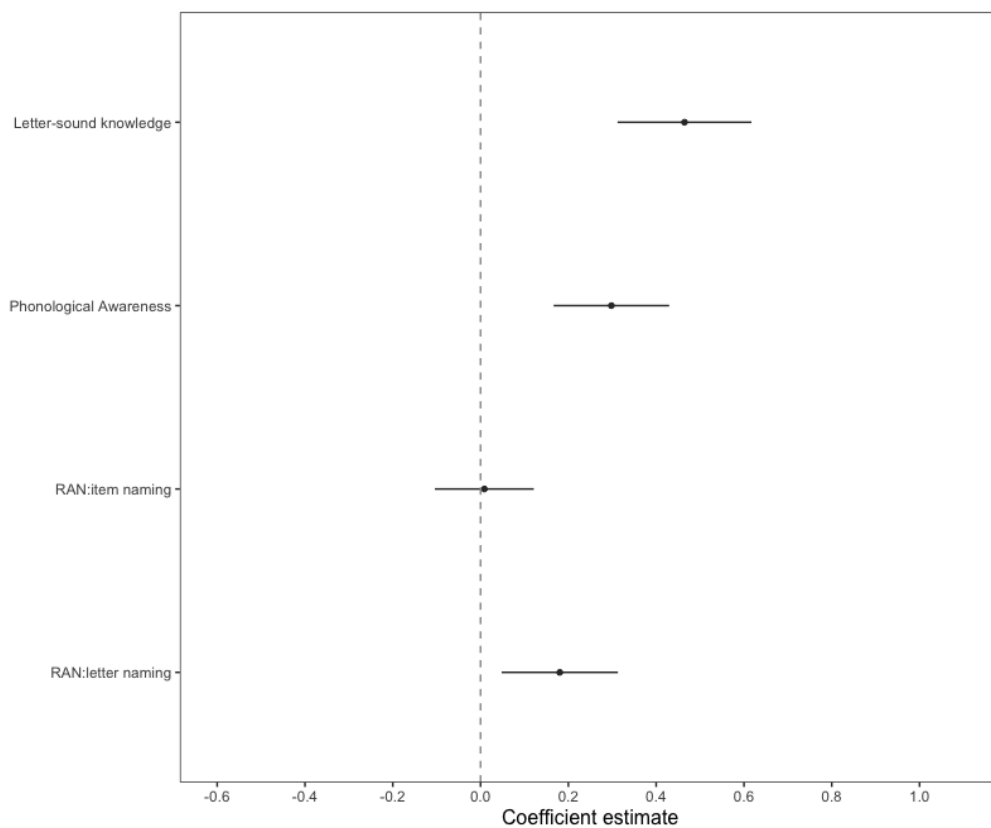


Figure 18: Dot and whisker plot – predictors of word specific orthographic knowledge

4.3.2.2 Predictors of general orthographic knowledge

As shown in Table 11 below, letter-sound knowledge, PA and RAN together had a significant effect on general orthographic knowledge, $F(4,135)=20.81, p<.001$, and explained 36% of the variance (adjusted $R^2=0.36$) in general orthographic knowledge. Similar to the model that predicted word specific orthographic knowledge, only letter-sound knowledge ($\beta=0.36$) and PA ($\beta=0.28$) were significant predictors, with letter-sound knowledge making the greatest contribution.

The model diagnostics are visualised in Figure 19 below and indicate that there were no violations of the assumptions of normality (see Normal Q-Q plot), linearity (see Residuals vs Fitted plot), homoscedasticity of residuals (see Scale-Location plot) and that there are no influential outliers evident (see Residuals vs Leverage plot) (Kassambara, 2018).

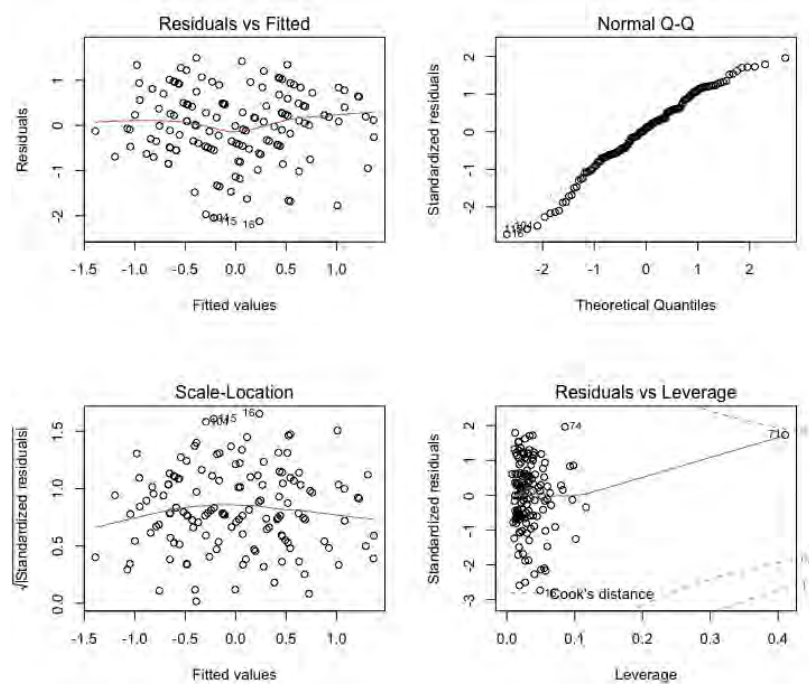


Figure 19: Diagnostic plots- predictors of general orthographic knowledge

Table 11: Multiple general linear regression - general orthographic knowledge predicted by letter-sound knowledge, PA and RAN

Predicted variable: General orthographic knowledge			95% Confidence Interval		
Predictors	SE	β	Lower	Upper	t
(Intercept)	0.07	-0.	-0.13	0.13	0
Letter-sound knowledge	0.1	0.36**	0.16	0.56	3.57
PA	0.09	0.28*	0.1	0.45	3.188
RAN: item-naming	0.07	-0.1	-0.25	0.04	-1.42
RAN: letter-naming	0.09	0.13	-0.04	0.3	1.52

*p < .05, **p < .001 SE = standard error

The results presented in Table 11 above are represented visually in the dot and whisker plot below (Figure 20). Variables to the right of the dotted line indicate those variables which were identified as significant predictors of general orthographic knowledge.

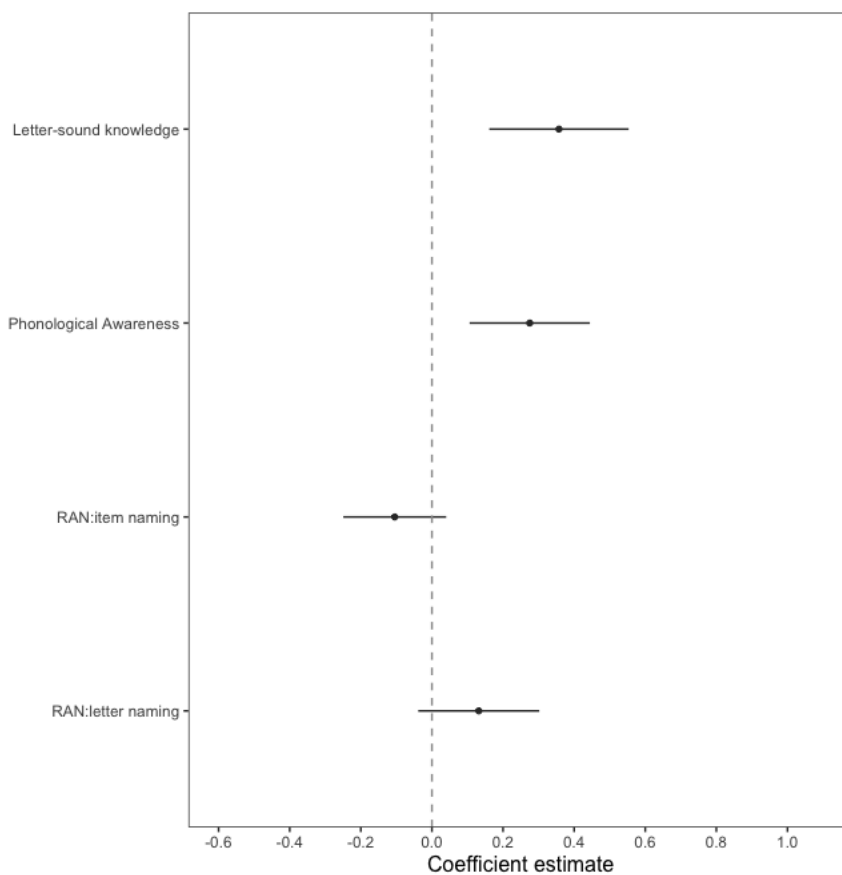


Figure 20: Dot and whisker plot – predictors of general orthographic knowledge

4.3.2.3 Predictors of reading

Table 12 considers ORF as the predicted variable, and word specific orthographic knowledge, general orthographic knowledge, letter-sound knowledge, PA and RAN as the covariates (predictors). Results of the multiple linear regression (Table 12) demonstrates that the variables accounted for 71% of the variance ($F(6,133)=57.02, p<.001$). The results are also displayed in the dot and whisker plot in Figure 22. All variables except PA were significant predictors of ORF in the following order of contribution: letter-sound knowledge ($\beta=0.39$), RAN letter-naming ($\beta=0.18$), word specific orthographic knowledge ($\beta=0.18$), general orthographic knowledge ($\beta=0.16$) and RAN (item-naming) ($\beta=0.1$).

An assessment of the model diagnostics revealed no significant violations of the assumptions of normality, linearity and homoscedasticity of residuals. See Figure 21 below.

However, there was one noticeable outlier in each of the plots which signifies a learner who scored very well on the ORF task (point 118). It was decided not to remove this participant, so that the sample included the full range of learner performance. This decision was particularly relevant considering the quantile regression analysis

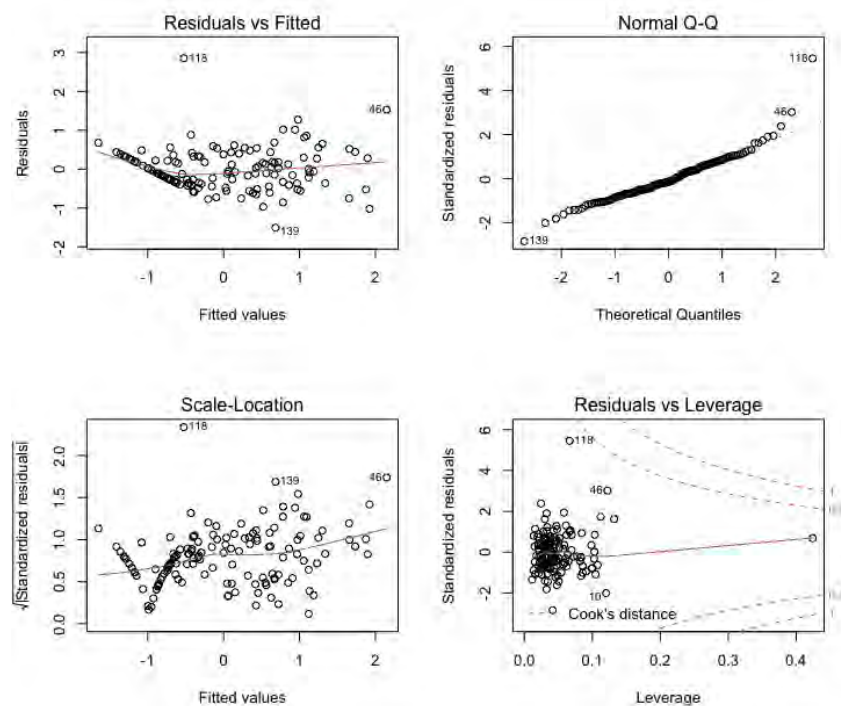


Figure 21: Diagnostic plots- predictors of reading

Table 12: Multiple general linear regression – ORF predicted by word specific orthographic knowledge, general orthographic knowledge, letter-sound knowledge, PA and RAN

Predicted variable: ORF			95% Confidence Interval		
Predictors	SE	β	Lower	Upper	t
(Intercept)	0.05	0	-0.09	0.09	0
Word specific orthographic knowledge	0.08	0.18*	0.03	0.34	2.33
General orthographic knowledge	0.06	0.16*	0.04	0.3	2.7
Letter-sound knowledge	0.08	0.39**	0.24	0.55	5.13
PA	0.06	0.07	-0.06	0.19	1
RAN: item-naming	0.05	0.1*	0	0.2	2.1
RAN: letter-naming	0.06	0.18*	0.06	0.3	3

*p < .05, **p < .001 SE = standard error

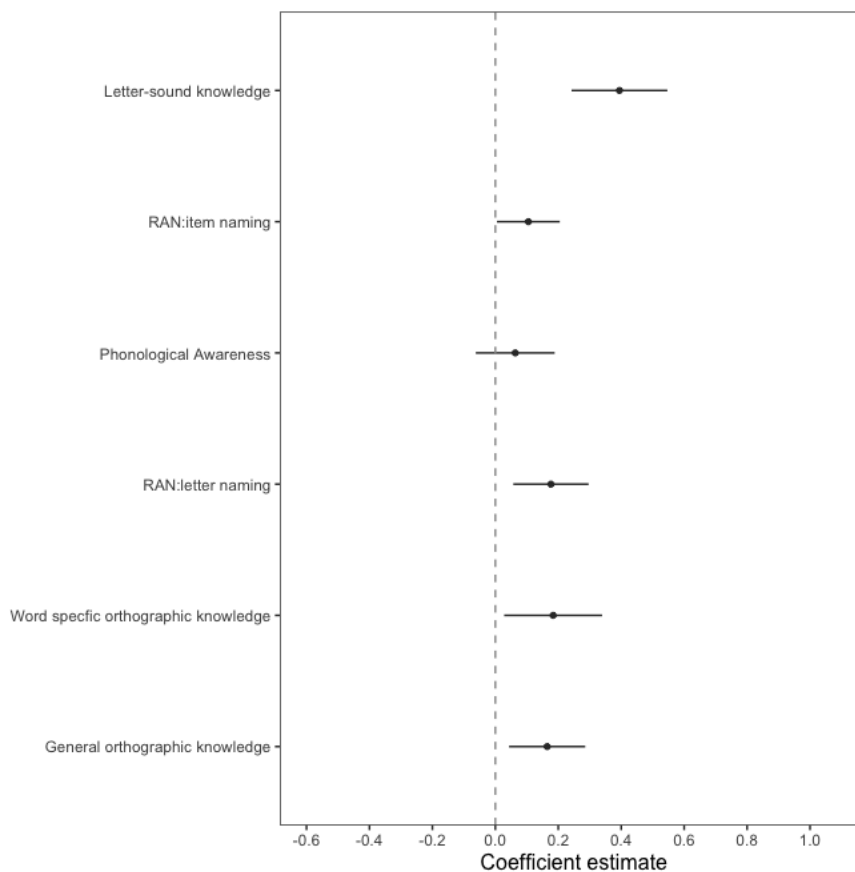


Figure 22: Dot and whisker plot – predictors of ORF

To further interrogate the relationships between the variables in the model presented in Table 13, a quantile regression fitted at the 0.1, 0.5 and 0.9 quantiles was conducted to explore whether the influence of the predictor variables depended on overall reading ability. These results are reported in Table 13 and Figure 23 below.

Table 13: Quantile regression model predicting ORF at the 0.1, 0.5 and 0.9 quantiles

Quantile	Predictor	β	SE	95% CI	Goodness of Fit
0.1	(Intercept)	-0.53	0.07	[-0.66, -0.39]	0.28
	Word specific orthographic knowledge	0.12	0.08	[-0.05, 0.28]	
	General orthographic knowledge	0.11	0.06	[-0.01, 0.24]	
	Letter-sound knowledge	0.3*	0.14	[0.02, 0.59]	
	RAN: items-correct-per-second	0.08	0.07	[-.06, 0.22]	
	RAN: letters-correct-per-second	0.11	0.07	[-0.03, 0.26]	
	Phonological awareness	0.06	0.06	[-0.06, 0.18]	
	0.5	(Intercept)	-0.05	0.06	
Word specific orthographic knowledge		0.19*	0.09	[0.02, 0.37]	
General orthographic knowledge		0.14	0.08	[-0.02, 0.3]	
Letter-sound knowledge		0.52**	0.12	[0.29, 0.75]	
RAN: items-correct-per-second		0.14	0.07	[0.01, 0.28]	
RAN: letters-correct-per-second		0.04	0.09	[-0.14, 0.22]	
Phonological awareness		0.04	0.08	[-0.12, 0.19]	
0.9		(Intercept)	0.65	0.11	[0.44, 0.86]
	Word specific orthographic knowledge	0.21	0.15	[-0.09, 0.51]	
	General orthographic knowledge	0.17	0.1	[-0.04, 0.37]	
	Letter-sound knowledge	0.42*	0.2	[0.01, 0.82]	
	RAN: items-correct-per-second	0.24*	0.12	[-0.01, 0.47]	
	RAN: letters-correct-per-second	0.19	0.13	[-0.06, 0.44]	
	Phonological awareness	0.20	0.14	[-0.07, 0.48]	

Notes: β and CIs estimated using 1000 bootstrapped resamples. Goodness of fit interpreted similarly to R^2 . Calculated according to Koenker and Machado (1999). * $p < .05$, *** $p < .001$ SE = standard error

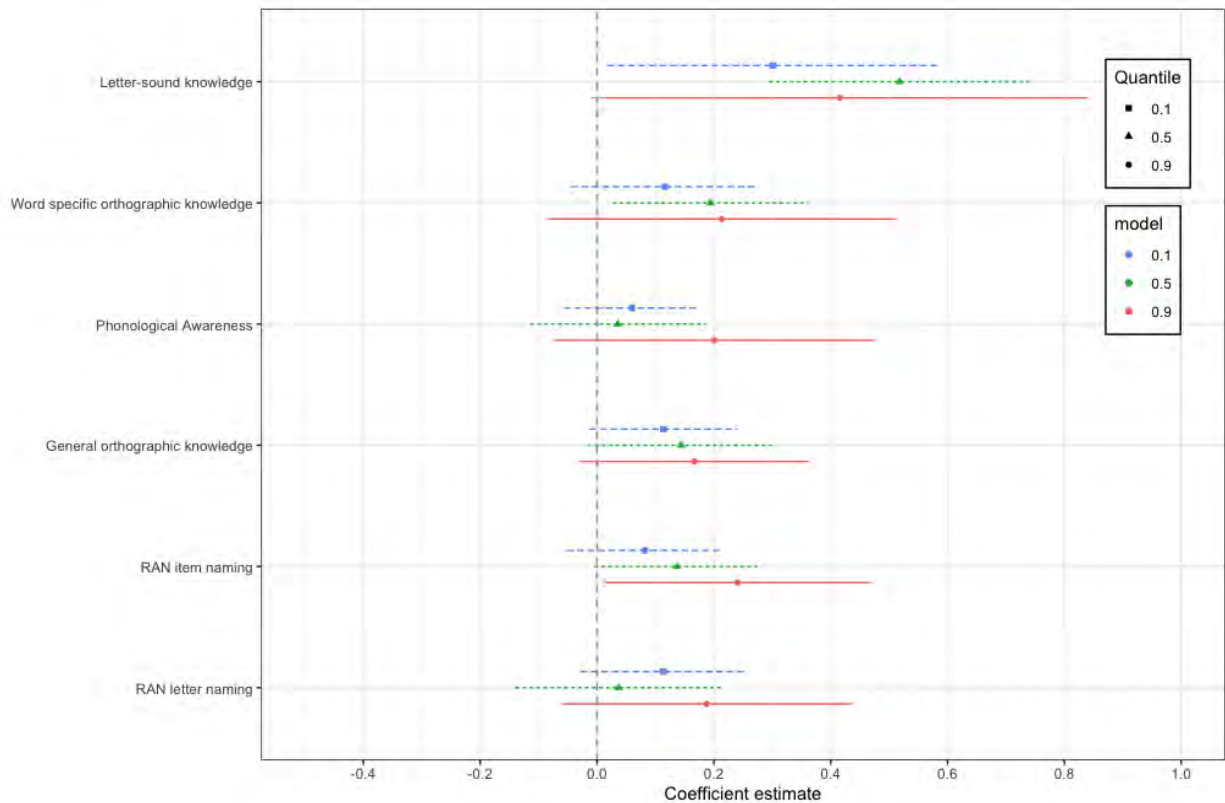


Figure 23: Dot and whisker plot - Quantile regression: predictors of ORF

The results illustrate that the strength of the relationship between reading and word specific orthographic knowledge, general orthographic knowledge, PA, letter-sound knowledge and RAN differs by reading proficiency. At the lowest reading level (quantile 0.1), the variables accounted for 28% of variance, and letter-sound knowledge was the only significant predictor ($\beta=0.3$, $t=2.09$, $p<0.05$). At the 0.5 quantile, the results from the linear regression were partially supported, as letter-sound knowledge ($\beta=0.51$, $t=4.5$, $p<0.01$) and word specific orthographic knowledge ($\beta=0.19$, $t=2.25$, $p<0.05$) were significant predictors. At this reading ability level, the goodness of fit increased to 0.54. At the highest reading ability level (quantile 0.9), only letter-sound knowledge ($\beta=0.42$, $t=2.02$, $p<0.05$) and RAN item-naming ($\beta=0.24$, $t=2.03$, $p<0.05$) were significant predictors of reading, and the goodness of fit increased slightly to 0.55.

4.3.2.4 Predictors of spelling

Table 14 considers spelling as the predicted variable and word specific orthographic knowledge, general orthographic knowledge, letter-sound knowledge, PA and RAN as the covariates (predictors).

An analysis of the diagnostic plots for the multiple linear regression showed that there were no significant violations of the assumptions of normality, linearity and homoscedasticity of residuals. See Figure 24 below.

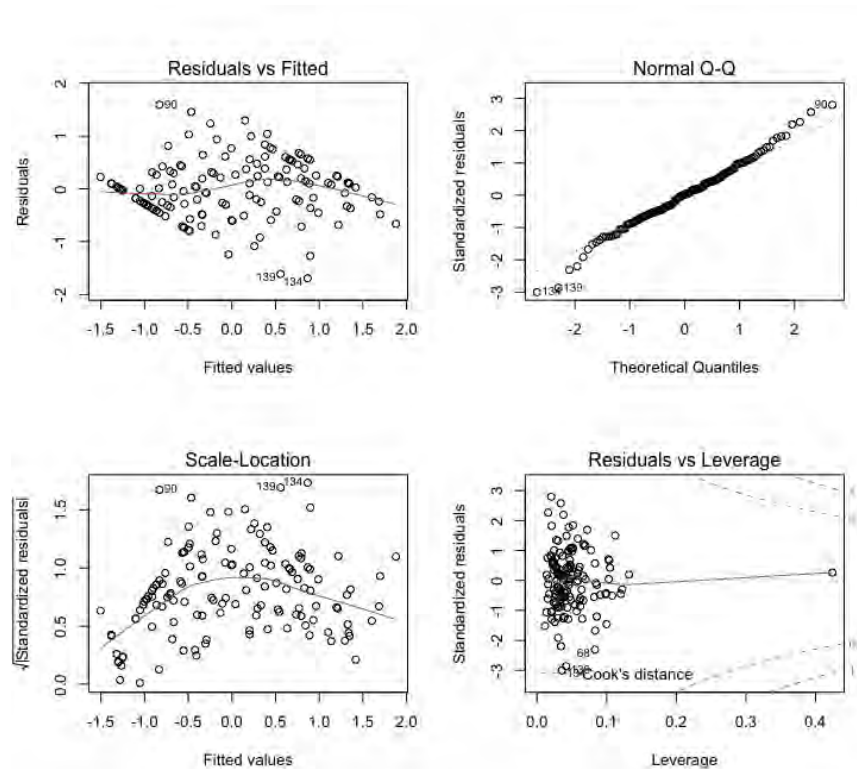


Figure 24: Diagnostic plots- predictors of spelling

The overall model regression was found to be significant, $F(6,133)=48, p<.001$. Together, the covariates explain 67% (adjusted $R^2=0.67$) of the variance. However, only word specific orthographic knowledge ($\beta=0.34$), and letter-sound knowledge ($\beta=0.44$) were significant predictors of spelling. The model diagnostics revealed no violations of the assumptions of normality, linearity and homoscedasticity of residuals.

Table 14: Multiple general linear regression - spelling predicted by word specific orthographic knowledge, general orthographic knowledge, letter-sound knowledge, PA and RAN

Predicted variable: Spelling			95% Confidence Interval		
Predictors	SE	β	Lower	Upper	t
(Intercept)	0.05	0	-0.1	0.1	0
Word specific orthographic knowledge	0.08	0.34**	0.17	0.5	4.05
General orthographic knowledge	0.07	0	-0.13	0.13	0.05
Letter-sound knowledge	0.08	0.44**	0.28	0.61	5.43
PA	0.07	0.07	-0.06	0.2	1.04
RAN: item-naming	0.05	0	-0.1	0.1	0.1
RAN: letter-naming	0.06	0.07	-0.05	0.2	1.2

*p < .05, **p < .001 SE = standard error

The results in Table 14 are presented graphically in Figure 25.

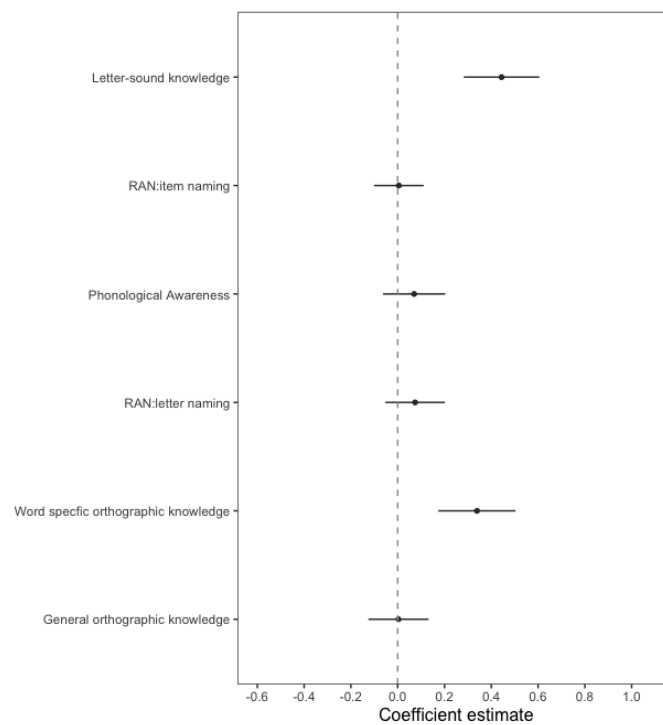


Figure 25: Dot and whisker plot – predictors of spelling

Similar to the previous section, a quantile regression was fitted at the 0.1, 0.5 and 0.9 quantiles to explore whether the influence of the predictor variables depended on overall spelling ability. These results are reported in Table 15 and shown in Figure 26. The results illustrate that the strength of the relationship between spelling and word specific orthographic knowledge, general orthographic knowledge, PA, letter-sound knowledge, and RAN differs by spelling

proficiency. At the lowest spelling level (quantile 0.1), the variables accounted for 28% of variance, and only word specific orthographic knowledge was a significant predictor ($\beta=0.33$, $t=2.7$, $p<0.05$). At the 0.5 quantile, the results from the multiple linear regression were supported as letter-sound knowledge ($\beta=0.6$, $t=5.3$, $p<0.01$) and word specific orthographic knowledge ($\beta=0.29$, $t=2.82$, $p<0.05$) were the only significant predictors of spelling. At this spelling ability level, the goodness of fit increased to 0.53. At the highest spelling ability level (quantile 0.9), only word specific orthographic knowledge ($\beta=0.32$, $t=2.3$, $p<0.05$) was a significant predictor of spelling, and the goodness decreased to 0.32.

Table 15: Quantile regression model predicting spelling at the 0.1, 0.5 and 0.9 quantiles

Quantile	Predictor	β	SE	95% CI	Goodness of Fit
0.1	(Intercept)	-0.64	0.11	[-0.85, -0.43]	0.28
	Word specific orthographic knowledge	0.33*	0.12	[0.09,0.58]	
	General orthographic knowledge	0.03	0.14	[-0.25,0.32]	
	Letter-sound knowledge	0.29	0.18	[-0.07,0.64]	
	RAN: items-correct-per-second	0.14	0.08	[-0.03,0.3]	
	RAN: letters-correct-per-second	0.17	0.13	[-0.09,0.44]	
	Phonological awareness	0.08	0.1	[-0.12,0.27]	
	0.5	(Intercept)	0.01	0.06	
Word specific orthographic knowledge	0.29*	0.1	[0.09,0.5]		
General orthographic knowledge	-0.04	0.07	[-0.19,0.11]		
Letter-sound knowledge	0.6***	0.11	[0.38,0.82]		
RAN: items-correct-per-second	0.02	0.06	[-0.09,0.14]		
RAN: letters-correct-per-second	0.08	0.09	[-0.1,0.25]		
Phonological awareness	0.03	0.12	[-0.2,0.25]		
0.9	(Intercept)	0.65	0.13	[0.4,0.91]	0.32
	Word specific orthographic knowledge	0.32*	0.14	[0.05,0.6]	
	General orthographic knowledge	0.01	0.12	[-0.22,0.24]	
	Letter-sound knowledge	0.34	0.19	[-0.04,0.72]	
	RAN: items-correct-per-second	-0.07	0.13	[-0.32,0.18]	
	RAN: letters-correct-per-second	0.08	0.14	[-0.2,0.36]	
	Phonological awareness	0.12	0.12	[-0.12,0.35]	

Notes: β and CIs estimated using 1000 bootstrapped resamples. Goodness of fit interpreted similarly to R^2 . Calculated according to Koenker and Machado (1999). * $p < .05$, *** $p < .001$ SE = standard error

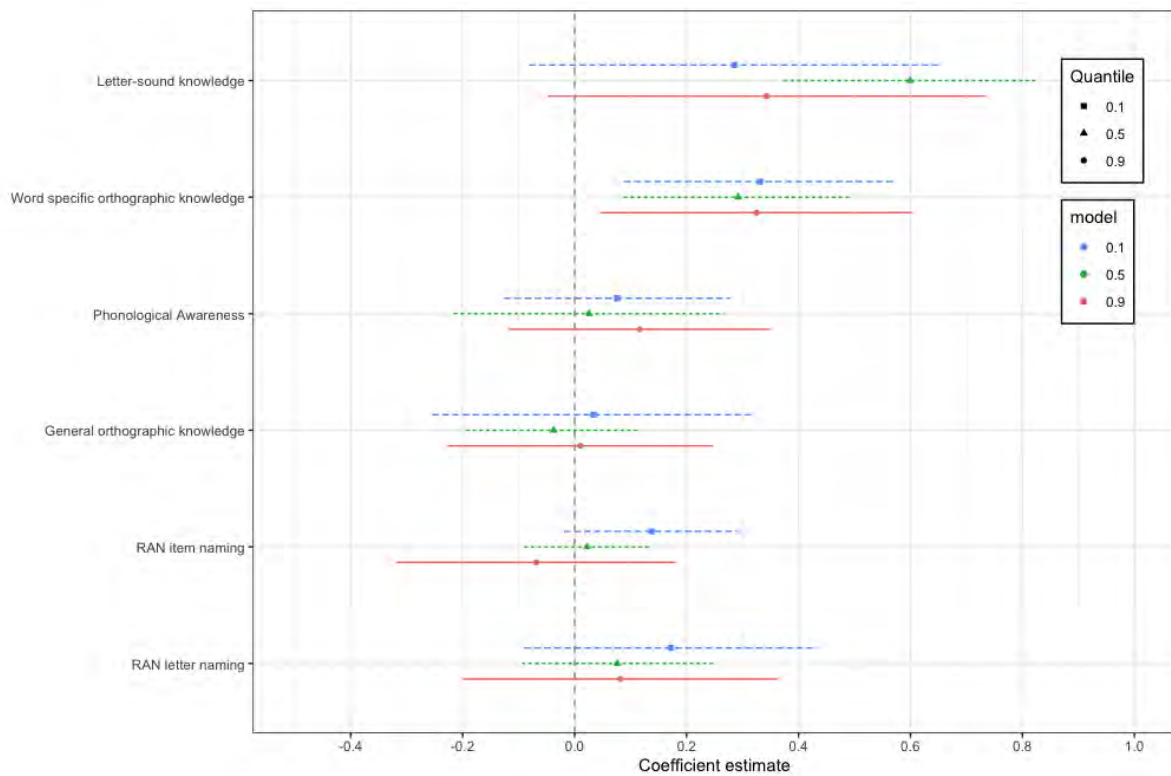


Figure 26: Dot and whisker plot - Quantile regression: predictors of spelling

4.3.2 Conclusion

This chapter presented the results of the data analysis conducted for the current thesis. In particular, letter-sound knowledge and PA were found to be significant predictors of word specific and general orthographic knowledge. Further, the role of word specific orthographic knowledge was shown to be influential for both reading and spelling. The main findings of this analysis are discussed in greater detail in the forthcoming chapter.

CHAPTER 5: DISCUSSION

5.1 Introduction

The primary objective of this thesis was to investigate the nature of orthographic knowledge in isiXhosa. In doing so, the thesis explored the contribution of orthographic knowledge to important literacy outcomes, namely reading and spelling, as well as established correlates of literacy development (letter-sound knowledge, RAN and PA). Further, the thesis sought to situate the main findings within the primary assertions of the self-teaching hypothesis and the dual route approach to orthographic processing.

This chapter provides an in-depth discussion of the main findings in succession of the research questions of this thesis. In each section, an explanation of the significance of the findings and their relevance to related literature is included. It is important to note that the findings of this thesis are representative of an exploratory investigation of orthographic knowledge in isiXhosa. Orthographic knowledge in isiXhosa is currently a novel area of interest in psycholinguistics and literacy research. Thus, the findings are discussed against this research background. In addition, suggestions for future research are proposed in each of the sections. The pedagogical implications of these findings are discussed in the Conclusion ([Chapter 6](#)).

5.2 What is the orthographic knowledge (word specific and general) of grade 3 isiXhosa home language learners?

Orthographic knowledge in isiXhosa was measured using specifically designed word specific and general orthographic knowledge tasks in this study. The results showed that the learners' performance was similar on the word specific ($M=6.9$, $SD=3.4$) and general orthographic knowledge ($M=7$, $SD=2.7$) tasks, with a student's paired samples t-test confirming that there was no statistically significant difference in the means for the two tasks, $t=0.49$, $df=139$, $p>0.05$, 95%, $CI=[-0.57;0.34]$, Cohen's $d=-0.04$. These findings suggest that the majority of these learners have a moderate grasp of orthographic knowledge, as measured in the current study (approximately 58% accuracy on both tasks). Kolmogorov Smirnov normality testing revealed overall non normal distributions of the data with no ceiling or floor effects evident. As the word specific and general orthographic knowledge tasks were specifically designed for use in this thesis, direct comparisons cannot be made.

Nevertheless, there are some studies which have looked at orthographic knowledge in languages with transparent orthographies, although their measures of orthographic knowledge differ to those used in the current study (e.g., German: Zarić *et al.*, 2021; Persian: Arab-Moghaddam & Senechal, 2001; Dutch: Bekebrede *et al.*, 2009; Russian: Rakhlin *et al.*, 2019) some comparisons can be made. For example, in Zarić *et al.* (2020), grade 3 German learners scored an average of 42% (M=8.41, SD=1.75) on the word specific orthographic knowledge task, and 53% (M=21.21, SD=4.16) on the general orthographic knowledge task. Further, Arab-Moghaddam and Senechal (2001) found that first language grade 3 Persian learners scored an average of 73% (M=29.25, SD=1.17) on a word specific orthographic knowledge task, compared to 68% for grade 2 learners (M= 27.56, SD=2.94). Thus, it can be said that the learners in the current sample are scoring higher on orthographic knowledge tasks compared to the German learners in Zarić *et al.* (2020), but weaker than the Persian grade 2 and 3 learners in Arab-Moghaddam and Senechal (2001). Similar to Zarić *et al.* (2020), the learners in the current study performed better on the general orthographic knowledge task than the word specific orthographic knowledge task; however, Zarić *et al.* (2020) did not attempt to explain this variance. Further cross-linguistic research is encouraged so that better comparisons can be made, especially between African languages and languages in other third-world countries.

As noted in the literature review, orthographic knowledge is linked to one's development of other literacy skills as reasoned through its relationship to spelling (Caravolas *et al.*, 2003; Alock & Ngorosho, 2003; Smythe *et al.*, 2008; Georgiou *et al.*, 2012; Diemer, 2015). Specifically, word specific orthographic knowledge relies on one's knowledge of specific words and their phonological representations (Apel, 2011). Thus, a strong foundation in PA is reasoned to be useful for word specific orthographic knowledge, and is supported by research that has identified a link between these variables (Stanovich & West, 1989; Ehri, 1995; Share, 1995; Ehri, 1997; Share, 1999). Further, the successful mapping of printed graphemes onto word names and sounds is a necessary automatic skill needed for word specific orthographic knowledge (Loveall *et al.*, 2013) which would require letter-sound knowledge. For general orthographic knowledge, a more general understanding of orthographic patterns in a language is needed. As the alphabetic principle forms part of general orthographic knowledge, a solid foundation in letter-sound knowledge is essential for general orthographic knowledge as it assists with the understanding of how to represent speech sounds by graphemes in language (Apel, 2011). The need for PA and RAN is also prevalent as general orthographic processing requires the rapid retrieval of phonological information linked to printed graphemes.

A possible explanation for the learners' results on the orthographic knowledge tasks could be that their relatively poor performance on the PA (45%), letter-sound knowledge (38.4 LCPM) and RAN tasks is having a cumulative effect on the observed performance on the orthographic knowledge tasks. The grade 3 learners in this sample are reading below the Nguni threshold of 40 LCPM for grade 1 at the start of grade 3 (Ardington *et al.*, 2021). In addition, the results section revealed that the majority of the learners in this sample are poor readers, with 70% reading below or at the grade 2 threshold of 20 WCPM (Ardington *et al.*, 2021). The learners' low scores on the underlying skills of reading, such as letter-sound knowledge, PA, and RAN, are indicative of the cumulative effect of a lack of a strong foundation in the above-mentioned metalinguistic skills. The same can be said for the learners' spelling performance, as their average was 46% (M=5.6).

As an explanation for the lack of difference in performance on the word specific and general orthographic knowledge tasks, research has shown that word specific and general orthographic knowledge work together, allowing individuals both to read and spell (Jorm & Share, 1983; Coltheart, 2005; Seymour, 2005; Perry *et al.*, 2007 as cited in Apel, 2011; Zhao *et al.*, 2017). This implies that these skills are linked, and that the learner's performance should be similar on these tasks seeing as the two tasks are argued to be measuring the same underlying skill, namely orthographic knowledge. A confirmatory factor analysis could be conducted to investigate the validity of this argument and is suggested for future research.

5.3 What is the relationship between letter-sound knowledge, PA, RAN and word specific and general orthographic knowledge in grade 3 isiXhosa home language learners?

The main findings as they pertain to research questions 2a and 2b are discussed in tandem in this section. This section will therefore discuss how PA, RAN (item and letter-naming) and letter-sound knowledge relate to word specific and general orthographic knowledge respectively.

Word specific orthographic knowledge correlated most strongly with letter-sound knowledge ($r=0.75$ CI [6.62, 0.81]), ORF ($r=0.73$ CI [6.47, 0.8]) and spelling ($r=0.75$ CI [6.73, 0.82]), but also correlated significantly with all of the other variables in the study. This finding is well represented in international literature which shows that orthographic knowledge is related to letter-sound knowledge, PA and RAN indexed through the relationship between spelling and

orthographic knowledge (Alock & Ngorosho, 2003; Caravolas *et al.*, 2003; Smythe *et al.*, 2008; Georgiou *et al.*, 2012; Diemer, 2015).

For general orthographic knowledge, weak to moderate and significant relationships with all variables, except RAN (item-naming), were evident. As noted above, the findings support the literature in showing that orthographic knowledge is related to PA, letter-sound knowledge, and alphanumeric RAN (Alock & Ngorosho, 2003; Caravolas *et al.*, 2003; Smythe *et al.*, 2008; Georgiou *et al.*, 2012; Diemer, 2015). These findings contribute to the literature by providing cross-linguistic research showing an association between word specific and general orthographic knowledge to PA, letter-sound knowledge, RAN, reading and spelling in isiXhosa. In addition, the relationships evident between word specific and general orthographic knowledge and the above-mentioned variables supports the predictions made (see [section 2.4](#)).

The relationships between word specific orthographic knowledge and the variables were much stronger than that of general orthographic knowledge, which suggests that word specific orthographic knowledge is a greater correlate of literacy development for grade 3 isiXhosa learners. However, this may also be a task effect in that the general orthographic knowledge task, while found to be reliable ($\alpha=0.65$), had a 35% unreliability index, compared to the 16% unreliability index of the word specific orthographic knowledge task ($\alpha=0.84$). To further examine the relationship between these variables, multiple linear regressions were conducted.

The results of these regression analyses showed that overall letter-sound knowledge and PA were significant dominant predictors of both word specific and general orthographic knowledge, with letter-sound knowledge having the greatest effect in both models. In addition, RAN letter-naming was also revealed to be a significant predictor of word specific orthographic knowledge. The model fit was reduced for the model which predicted general orthographic knowledge, $F(4,135) = 20.81, p < .001$, adjusted $R^2 = 0.36$, compared to the model which predicted word specific orthographic knowledge, $F(4,135) = 56.35, p < .001$, adjusted $R^2 = 0.61$. This is indicative of the weaker correlations evident between the independent variables and general orthographic knowledge, compared to that of word specific orthographic knowledge.

The findings indicate that letter-sound knowledge was the greatest contributor for both word specific (letter-sound knowledge: $\beta=0.36$) and general orthographic knowledge (letter-sound

knowledge: $\beta=0.39$). This can be explained by the fact that both word specific and general orthographic knowledge require the successful understanding of how speech should be converted to print graphemes in a language (Apel, 2011; Loveall *et al.*, 2013). Letter-sound knowledge has been found to contribute to children's early literacy in alphabetic languages (Huang *et al.*, 2014; Landerl *et al.*, 2022) and research suggests that the more systematic the relationships are between the letters and sounds within a language, the easier it will be to master letter-sound knowledge in that language (Treiman *et al.*, 1998; McBride-Chang, 1999; Evans *et al.*, 2006; Justice *et al.*, 2006; Scanlon *et al.*, 2010; Huang & Invernizzi, 2012). Further, the relationship between letter-sound knowledge and spelling is stronger in languages with transparent orthographies (Oney & Durgunoglu, 1997; Leppänen *et al.*, 2006). Due to the relationship between spelling and orthographic knowledge, we can surmise that this extends to the relationship between orthographic knowledge and letter-sound knowledge. Thus, for a language like isiXhosa, which has a transparent orthography, the relative ease of access to letter-sound knowledge may mean that learners learning in isiXhosa exploit this skill throughout their learning development due to its ease of accessibility and consistency.

PA was found to be the second most dominant predictor of word specific (PA: $\beta=0.30$), and general orthographic knowledge (PA: $\beta=0.28$). Literature that looks at the relationship between spelling and PA is mainly used for comparison, as there is limited research that looks at the direct relationship between PA and orthographic knowledge. Therefore, the above-mentioned finding is supported by the literature in that PA has been identified as an important contributor to spelling internationally (Bruck & Treiman, 1990; Treiman, 1993) and for African languages (Alcock & Ngorosho, 2003; Diemer, 2015; Makaure, 202; Daries, 2019; Veii, 2003; Soares De Sousa *et al.*, 2010; Nghikembua, 2020; Makaure, 2021). Research that has considered the unique relationships between word specific and general orthographic knowledge and PA are rare, but those in support of the self-teaching hypothesis have asserted that the development of word specific orthographic knowledge is largely dependent on phonological processing abilities with multiple studies supporting a strong relationship between these variables (Stanovich & West, 1989; Ehri, 1995; Share, 1995, Ehri, 1997; Share, 1999), thus providing further support for the findings of this thesis.

An explanation for the apparent relationship between PA, letter-sound knowledge, and orthographic knowledge is reasoned by the fact that all written language learning requires exposure to the sounds of the language, and that for one to understand how speech sounds and

written graphemes correspond, one would first need a solid understanding of speech sounds to enable the formation of an orthographic lexicon (Ehri, 1992; Share, 1995; Ehri, 2005; Share, 2008; Ehri, 2014 as cited in Rakhlin *et al.*, 2014). Therefore, it can be suggested that PA is a necessary base for orthographic knowledge development. However, knowledge of the sounds of language is not enough for one to form a solid foundation of orthographic knowledge. Thus, letter-sound knowledge reinforces the knowledge of the sounds of a language with a written basis which is needed for the conversion of sounds to graphemes that ultimately reinforces orthographic knowledge. In accordance, the findings of this thesis suggest that PA is necessary, but insufficient for orthographic knowledge development.

The findings show that for the most part, the same metalinguistic skills underlie both word specific and general orthographic knowledge. This can be expected as these tasks are reasoned to be measuring the same latent variable, namely orthographic knowledge. However, the fact that RAN letter-naming was found only to be predictive of word specific orthographic knowledge suggests that there might be important differences between word specific and general orthographic knowledge. The few studies that have looked at the relationship between RAN and orthographic knowledge have shown that they are interlinked, and thus they partially support the finding indicating a relationship between word specific orthographic knowledge and RAN (Manis *et al.*, 1999; Manis *et al.*, 2000; Sunseth & Bowers, 2002). However, these studies did not look at the subcomponents of orthographic knowledge, but rather considered it as an individual skill making further comparisons infeasible.

With regards to the relationship between RAN letter-naming and word specific orthographic knowledge, the literature is rather limited in its explanation thereof. Georgiou *et al.* (2008a) found that orthographic knowledge and RAN correlated significantly. Similarly, Manis' (2000) study showed that alphanumeric (letters) and non-alphanumeric (digits) RAN correlated with word specific and general orthographic knowledge, with R ranging from 0.3 – 0.64. In line with the findings of the current study, Loveall *et al.* (2013) discovered that alphanumeric RAN contributed greater to word specific orthographic knowledge than general orthographic knowledge. They refer to the arguments of Wolf and Bowers (1999) in their explanation of this relationship. Wolf and Bowers (1999) argue that RAN allows for the linking between letters and orthographic representations, and then into words. As RAN letter-naming is likely to be more automatized than RAN item-naming for grades 2 to 3 learners, Loveall *et al.* (2013) surmise that this is why RAN letter-naming predicts word specific orthographic knowledge

more strongly. However, each of these above-mentioned studies were conducted with English participants, with no studies that have investigated this relationship in an African language.

There are multiple theories that try to explain the relationship between RAN and reading which can help explain the RAN and orthographic knowledge relationship. Firstly, it has been argued that RAN taps into a part of the brain that deals with access to, and retrieval of, phonological information stored in our long-term memory (Wagner & Torgesen, 1987; Torgesen *et al.*, 1997). For the word specific orthographic knowledge task used, learners needed to retrieve rapidly the phonological and orthographic information needed to identify the incorrect grapheme in familiar isiXhosa words, providing a possible explanation for the link between RAN letter-naming and word specific orthographic knowledge. It has also been argued that RAN is important for spelling in transparent orthographies as it facilitates the rapid access to phonological information which would in turn allow for the creation of quality orthographic representations needed for spelling (Wolf & Bowers, 1999; Smythe *et al.*, 2008; Georgiou *et al.*, 2012). This provides support for the relationship between word specific orthographic knowledge and RAN due to the relationship between spelling and RAN. It may also be that the RAN letter-naming task was found to be associated with word specific orthographic knowledge, as both tasks dealt with the recognition and identification of real letters in isiXhosa, in isolation for the RAN letter-naming task and within words for the word specific orthographic knowledge task. This could possibly explain why RAN letter-naming was not found to be predictive of general orthographic knowledge as the task included nonwords and pseudowords which could have made it difficult for the learners to make clear associations between the isiXhosa alphabet and the stimuli provided. Additional research is recommended in order to better understand the relationship between RAN letter-naming and word specific orthographic knowledge better.

Research that explores the direct predictors of word specific and general orthographic knowledge is sparse, and thus the findings of this thesis add to the literature by indicating that both PA and letter-sound knowledge uniquely predict word specific and general orthographic knowledge in isiXhosa, with RAN letter-naming also being a significant predictor of word specific orthographic knowledge.

5.4 What are the unique contributions of orthographic knowledge (word specific and general), letter-sound knowledge, RAN and PA to reading and spelling of grade 3 isiXhosa home language learners?

The goal of research questions 3a and 3b was to determine the unique predictive value of word specific and general orthographic knowledge for reading and spelling among isiXhosa grade 3 learners, while controlling for the contribution of letter-sound knowledge, RAN (item and letter-naming) and PA. The main findings as they pertain to research questions 3a and 3b are discussed together in this section.

All variables except PA were significant predictors of reading, $F(6,133) = 57.02, p < .001$, adjusted $R^2 = 0.71$. Letter-sound knowledge ($\beta = 0.39$) had the greatest effect, followed by RAN letter-naming ($\beta = 0.18$) and word specific orthographic knowledge ($\beta = 0.18$). General orthographic knowledge ($\beta = 0.16$) and RAN (item-naming) ($\beta = 0.1$) had the smallest effect on the overall variance. For spelling, only word specific orthographic knowledge ($\beta = 0.34$) and letter-sound knowledge ($\beta = 0.44$) were found to be significant predictors. Research has shown that orthographic knowledge is linked to reading and spelling (Adams, 1990; Templeton & Morris, 2000; Cunningham *et al.*, 2001; Ouellette and Senechal, 2008; Loveall *et al.*, 2013; Fleisch *et al.*, 2017; Zhao *et al.*, 2017; Zarić *et al.*, 2020). The current study supports this, by showing that word specific orthographic knowledge is important for both reading and spelling in isiXhosa, with general orthographic knowledge also found to be important for reading, but not for spelling. Furthermore, these findings are congruous with the hypothesis made in section 2.3 that orthographic knowledge would be a significant predictor of reading and spelling in isiXhosa and, in addition provides nuance to this initial hypothesis by showing the unique contribution of word specific and general orthographic knowledge for reading and spelling in isiXhosa.

Word specific orthographic knowledge is reasoned to be important for both reading and spelling development as it assists with the direct identification of specific words in a language which is necessary for fluent reading and spelling (Zarić *et al.*, 2020). General orthographic knowledge is considered to be useful for reading development because of the important role it plays in the connection-forming processes necessary to develop word specific representations in memory, which in turn assists with reading (Conrad *et al.*, 2013). Further, the knowledge of letter patterns and rules provides readers with the information needed to be able to read any written word, especially unfamiliar words, assisting them with reading (Ehri, 2005). Zarić *et*

al.'s (2020) study that looked at the contribution of word specific and general orthographic knowledge for reading and spelling in German, also found that word specific orthographic knowledge contributed greater variance towards spelling than general orthographic knowledge. Zarić *et al.* (2020) suggest this provides evidence for the importance of the accurate retrieval of specific words from one's mental lexicon for spelling in German. This was also found with transparent languages such as Persian and Dutch (Arab-Moghaddam & Senechal, 2001; Bekebrede *et al.*, 2009). As both isiXhosa and German have relatively transparent orthographies, it suggests that specific word retrieval in both their phonological and orthographic forms are necessary for spelling in isiXhosa. However, contrary to the findings of Zarić *et al.* general orthographic knowledge was not found to be a significant predictor for spelling in the current study.

In addition, the findings indicate that letter-sound knowledge is of crucial importance for both reading and spelling in isiXhosa. As noted previously, letter-sound knowledge has been found to contribute to children's early literacy in alphabetic languages (Huang *et al.*, 2014; Landerl *et al.*, 2022) and has been stated to be an early literacy landmark necessary for subsequent development (Liberman *et al.*, 1990). Therefore, it was suggested that because of isiXhosa's transparent orthography, learners exploit the use of letter-sound knowledge in these languages for literacy development. Further, the relationship between spelling and letter-sound knowledge is said to be greater in languages with transparent orthographies than in opaque orthographies (Oney & Durgunoglu, 1997; Leppänen, *et al.*, 2006) due to the fact that spelling requires a conversion of speech to text that demands a well-established knowledge of the mapping of letters and sounds in a language, which is made easier in languages where the letter-sound mappings are more consistent. Thus, the findings show that due to isiXhosa's transparent orthography, the relative ease of access to letter-sound knowledge may potentially mean that learners are over-relying on letter-sound knowledge for reading and spelling. However, the predominance of letter-sound knowledge may also be indicative of the learners' poor reading and spelling ability. As previously noted, these learners were found to be majority poor readers when their performance was compared to the Nguni benchmarks (Ardington *et al.*, 2021).

The findings indicating that both RAN item- and letter-naming contributed to reading is supportive of the literature which shows that RAN is a significant correlate of reading in a number of alphabetic languages, with varying degrees of transparency (De Jong & Van der

Leij, 1999; Compton, 2003; Kirby *et al.*, 2003; Parrila *et al.*, 2004; Lepola *et al.*, 2005; Caravolas *et al.*, 2013; Makaure, 2016, 2021; Powell & Atkinson, 2021) including isiXhosa (Schaefer *et al.*, 2020).

Quantile regressions showed that for those learners who are at the lowest reading ability (0.1 quantile), letter-sound knowledge is the only significant predictor of reading ($\beta=0.3$, $t=2.09$, $p<0.05$) and only word specific orthographic knowledge was a significant predictor ($\beta=0.33$, $t=2.7$, $p<0.05$) of spelling. The literature emphasizes the role of letter-sound knowledge for early reading development across languages (Ellis & Large, 1988; Liberman *et al.*, 1990), thus explaining the significance of letter-sound knowledge at this level of tau for reading. To my knowledge, there are currently no studies that examine the longitudinal development of orthographic knowledge in transparent languages and thus the findings contribute to the literature by emphasizing the role of word specific orthographic knowledge for early spelling development.

For those learners who are reading at the average reading rate for the sample (0.5 quantile), letter-sound knowledge and word specific orthographic knowledge were the only significant predictors of both reading and spelling in the respective models. This finding partially supports the results of the multiple linear regression that predicted reading which showed that letter-sound knowledge and word specific orthographic knowledge are significant predictors of reading along with RAN and general orthographic. The results of the linear regression for spelling are fully supported by the findings of the quantile regression.

As already noted, the learners in this sample are poor readers, and thus while the 0.5 quantile represents the average readers for this sample, these readers are still poor readers in comparison to national benchmarks (Ardington *et al.*, 2021). Thus, the results align with international research that states letter-sound knowledge is important for early reading development and a similar argument can be made for spelling development. It is evident that for these grade 3 learners, there is a reliance on letter-sound knowledge during the very beginning stages of reading (0.1 quantile), but, as they progress (0.5 quantile), they move to a greater reliance on the orthographic features of the language. This may be due to the likelihood of greater exposure to print that has shown to propel one's orthographic development (Stanovich and West, 1989; Barker *et al.*, 1992; Berninger 1994; Fletcher-Flinn & Thompson 2004). As letter-sound knowledge deals with the knowing of the names and sounds linked to the letters of the alphabet,

it can be reasoned easily that once learners have a strong foundation in this ability, they may be able to move onto blending sounds into words and understanding the specific parts of words in a language in both their written and phonological forms (i.e. word specific orthographic knowledge). In line with the development perspective of Gentry (1982), the results of the quantile regression support that these learners are possibly progressing from a reliance on phonological knowledge to a dependence on orthographic and morphological knowledge when spelling (Schlagel, 2007; Bourassa & Treiman, 2010) as reflected in the continued reliance on word specific orthographic knowledge and the lack of significance of PA.

At the highest spelling ability level (quantile 0.9), only word specific orthographic knowledge ($\beta=0.32$, $t=2.3$, $p<0.05$) was a significant predictor of spelling, and only letter-sound knowledge ($\beta=0.42$, $t=2.02$, $p<0.05$) and RAN item-naming ($\beta=0.24$, $t=2.03$, $p<0.05$) were significant predictors of reading. The reliance on letter-sound knowledge for reading at this level, which one can assume includes the relatively stronger readers of the sample, supports the argument that these learners are perhaps using letter-sound knowledge as a ‘crutch’ throughout their reading development due to its accessibility and consistency in line with the language’s transparent orthography. This suggests that even at this level (0.9 quantile), these readers still may not have a solid foundation in key literacy building blocks leading to an over-reliance on letter-sound knowledge. Similar to the results of the quantile regression which predicted ORF, non-alphanumeric RAN was also found to be a significant predictor of reading in Schaefer *et al.*’s (2020) study with grade 3 isiXhosa readers. The readers in their study were reading approximately 5 more WCPM than the current sample. They also found that morphological awareness was a significant predictor of reading for grade 3 isiXhosa readers after controlling for PA (Schaefer *et al.*, 2020). This suggests that other metalinguistic skills need to be included in the model to fully comprehend the predictors of reading in isiXhosa. The fact that the goodness of fit was decreased to 0.32 at this quantile also suggests that other variables need to be considered in the reading model, for example, morphological awareness, word recognition ability, and vocabulary knowledge. These variables were not considered in the current thesis as they fell outside of the scope of investigation for this thesis.

Future longitudinal research that examines the predictive nature of word specific and general orthographic knowledge for reading and spelling combined with letter-sound knowledge, RAN, PA, morphological awareness, and vocabulary knowledge is suggested, so that we may

gain a better understanding of the relationship between these metalinguistic skills and their role for reading and spelling in isiXhosa.

Ellis' (1993) dual route model of reading (and spelling) purports that spelling is accessed either via phonological routes (reliance on sound-to-spelling regularities) or orthographic routes (reliance on accessibility of word specific orthographic memory). Thus, the findings mentioned above also support an argument for a reliance on orthographic route processing for spelling in isiXhosa. This line of argument is further explored in the following section ([section 5.5.2](#)) which looks at how the findings from the above research questions can be situated within the assertions of the dual route approach of orthographic processing.

The findings show that letter-sound knowledge is a robust predictor of reading and that word specific orthographic knowledge is a robust predictor of spelling, as these variables were found to be significant at all levels of tau. As such, the role of letter-sound knowledge and word specific orthographic knowledge is not dependent on overall reading and spelling ability. Further, these findings demonstrate that learners rely on different metalinguistic skills for reading and spelling in isiXhosa.

Interestingly, PA was not found to be a significant predictor for reading or spelling at any level of tau, or in the multiple linear regression. Schaefer *et al.* (2020) noted a similar finding in their study of isiXhosa grade 3 learners. They suggest that the role of PA in reading fluency in isiXhosa may previously have been overestimated, as many studies which have looked at PA in isiXhosa have not also controlled for other variables. The results of the current study provide further support for this conclusion. While PA is not included in the model as a direct predictor of reading, this does not suggest that it is not important, but rather that as learners progress the role of PA becomes more mediatory rather than having a direct impact on literacy outcomes. Theories of reading development (e.g., Ehri, 1992; Seymour, 2006) have argued that learners progress in their reading from a reliance on phonological information to a reliance on whole-word recognition in later years. Studies have also shown that PA may only be important for the first year or second year of schooling (De Jong & Van der Leij, 2002; Leppänen *et al.*, 2006; Lyytinen *et al.*, 2006; Papadopoulos *et al.*, 2009). Future research looking at the longitudinal predictors of reading and spelling at different ability levels, as well as the direct and indirect relationship between variables, is encouraged so to understand the development of reading and spelling in isiXhosa better.

The following section (section 5.5) looks at two theories of reading development that incorporate the role of orthographic skill to a considerably larger extent than traditional reading theories. These are the self-teaching hypothesis and the dual route approach of orthographic processing (Jorm & Share, 1983; Share, 1995, 1999; Grainger & Ziegler, 2011). The discussion looks at how the findings of this thesis can be situated within the assertions of these two theories.

5.5 How can the findings from the above research questions be situated within the assertions of the self-teaching hypothesis and the dual route approach to orthographic processing?

5.5.1 Self-teaching hypothesis

The self-teaching hypothesis (Jorm & Share, 1983; Share, 1995, 1999) asserts that word specific orthographic knowledge develops as a direct consequence of phonological skill. As an extension, it assumes that the laborious act of learning sounds in words (phonological recoding) will allow learners to teach themselves the orthographic representations of words for reading incidentally (Connors *et al.*, 2011). While the current study did not assess phonological recoding per se, phonological awareness is a subcomponent of phonological processing, and thus making a comparison seems viable (Wagner & Torgesen, 1987).

In line with the main assertions of the self-teaching hypothesis and the predications made in [section 2.5.1](#), the findings of this thesis indicate that there is a link between word specific orthographic knowledge and phonological skill (Jorm & Share, 1983; Share & Jorm, 1987; Share, 1995). The correlation matrix showed that PA was significantly correlated with both word specific ($r=0.6$) and general orthographic knowledge ($r=0.5$), and that PA was predictive of both word specific ($\beta=0.30$) and general orthographic knowledge ($\beta=0.28$).

As previously noted, the self-teaching hypothesis purports that the relationship between word specific orthographic knowledge and phonological skill is linear, in that phonological skill supersedes orthographic knowledge (Jorm & Share, 1983; Share & Jorm, 1987; Share, 1995). In support of the self-teaching hypothesis, Burt (2006) states that word specific orthographic knowledge should be regarded as an outgrowth of phonological skills, and not as a separate skill. However, the findings of this thesis suggest that word specific orthographic knowledge is a separate skill, as it was found to contribute unique variance towards reading after

controlling for PA. This finding is in line with a counter argument of the self-teaching hypothesis, which argues that while word specific orthographic knowledge is reliant on phonological skill to some degree, if the capacity of one's orthographic lexicon was entirely a consequence of phonological processes, then orthographic skill should not present independent variance (Cunningham *et al.*, 2011) as found in a number of studies (Stanovich & West, 1989; Cunningham & Stanovich, 1990, Barker *et al.*, 1992). Thus, the findings of this thesis suggest that while word specific orthographic knowledge and PA are linked, this relationship is not necessarily one of dependence as described by the self-teaching hypothesis. It suggests that PA is a necessary prerequisite for the development of word specific orthographic knowledge, but that PA is not completely sufficient. Share (1995: 200) acknowledges this by stating that while the hypothesis prioritizes the role of phonological processes for word reading, the hypothesis itself is not a "single-factor theory" and the role of other variables should be taken into consideration. As evidence for this argument, it was found that letter-sound knowledge explained the greatest variance for word specific orthographic knowledge in this thesis.

In their examination of the relationship between PA and orthographic knowledge, Connors *et al.* (2011) suggests that the self-teaching hypothesis provides an argument for orthographic knowledge acting as a mediator between phonological skill and word reading. This is reasoned by the fact that the self-teaching hypothesis states that as learners develop in the phonological skill, they will incidentally also develop their orthographic knowledge, which will in turn make them better at word reading. Thus, if greater phonological skill allows for stronger orthographic knowledge, then it should be the case that phonological skill contributes to word reading indirectly through its influence on orthographic knowledge, suggesting a full or partial mediation of orthographic knowledge. Connors *et al.*'s (2011) study with grade 2 and grade 3 English participants found that the relationship between reading and phonological skill was in fact significantly mediated by orthographic knowledge, supporting the need for the self-teaching hypothesis to be extended.

While the current thesis did not conduct a mediation analysis, the results of the multiple linear regression, which predicted reading, showed that PA was not a significant predictor, but that word specific and general orthographic knowledge were. This suggests that, for isiXhosa, PA might be mediating the relationship between orthographic knowledge and reading. The argument presented is that for isiXhosa, PA fosters the development of orthographic knowledge, but that as learners develop greater decoding abilities, PA becomes less prominent.

Orthographic knowledge then dominantly intervenes, delegating PA to a more mediatory role for reading development. This is highlighted as an area for further investigation in future research.

It is important to acknowledge that the current study did not conduct a self-teaching hypothesis analysis with the learners as it was not in the scope of the thesis. In such an analysis, participants are typically asked to phonologically recode target words, which can be either real or nonwords, in isolation or connected text. Their orthographic learning of these target words is then tested 3 to 7 days later (Loveall *et al.*, 2013). As noted above, researchers may choose to use differing stimuli for their measures, and depending on the stimuli used, different contributing factors might be affecting the orthographic learning outcome results (Cunningham, 2006). While the body of research that examines empirical evidence for the self-teaching model is expansive, as mentioned above, there often tends to be discrepancies in the measures used. This is coupled with vast differences in linguistic structure of the languages examined, which creates issues for the generalizability of the findings (Cunningham, 2006).

Notwithstanding this limitation of the thesis' discussion of the self-teaching hypothesis, the findings presented warrant a deeper investigation of the self-teaching hypothesis in its explanation of reading for isiXhosa grade 3 readers.

In the following section, the findings of the thesis are discussed in light of the assertions of the dual route approach to orthographic processing.

5.5.2 Dual route approach to orthographic processing

The dual route approach to orthographic processing describes two fundamentally different kinds of orthographic sub-lexical routes used when reading (Grainger & Ziegler, 2011). The two routes are theorized to develop out of different constraints placed on learners when reading, and thus the approach is theorized to assist learners by optimizing their ability to map printed graphemes to meaningful words when reading. Grainger and Ziegler (2011) hypothesize two main constraints when reading: firstly, the skills needed in order for learners to select specific combinations of letters which inform the identity of words, and, secondly, the optimization required for the identification of corresponding letter combinations to sub-lexical phonological and morphological representations in words. According to Grainger and Ziegler (2011), these constraints give rise to the two sub-lexical routes or orthographic codes linked to the dual route

architecture, namely, the coarse-grained and a fine-grained code, represented in the copy of Figure 4 below (Figure 27).

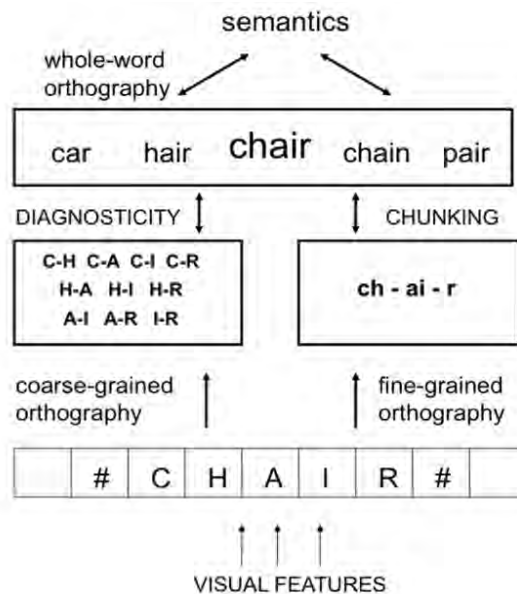


Figure 27: Dual route model of orthographic processing (Grainger & Ziegler, 2011: 3)

On the left of Figure 27 above, there is the coarse-grained orthographic code which is linked to diagnostic processing of letter combinations (Grainger & Ziegler, 2011). For this route, readers need to focus on the distinct orthographic characteristics of words to ‘diagnose’ the whole-word orthographic representation. This route is said to enhance learners' ability to access the meaning of words rapidly, as they need to retain minimal information about letter combinations in order to identify words. Based on this description, I surmised that the coarse-grained orthographic code represents the processing of word specific orthographic knowledge.

The second sub-lexical route, found on the right side of Figure 4, is the fine-grained orthographic code (Grainger & Ziegler, 2011). In this route the frequency of co-occurring letter combinations enables the reader to ‘chunk’ these combinations together to reduce the amount of information being processed when reading new words. Unlike the coarse-grained orthographic route, this route provides more precise information about the order and pattern of letter strings (Grainger & Ziegler, 2011). Orthographic processing along this route allows learners to ‘chunk’ frequently co-occurring letter combinations, which constitute word units for both morpho-orthographic processing and for the conversion of printed graphemes onto sounds. Grainger and Ziegler (2011) state that while this may seem to represent a model-guided

definition of general orthographic knowledge, it is important to note that this route is more generally linked to the ‘chunking’ of frequently co-occurring adjacent letter combinations, as opposed to being dedicated to identifying letter patterns. Nevertheless, the similarities between this route and that of general orthographic knowledge are clearly apparent, and I tentatively suggest that this route may provide a partial explanation of the processing of general orthographic knowledge.

Figure 28 provides a copy of the illustration of the predicted link between the coarse-grained and fine-grained orthographic sub-lexical routes and word specific and general orthographic knowledge using an isiXhosa example.

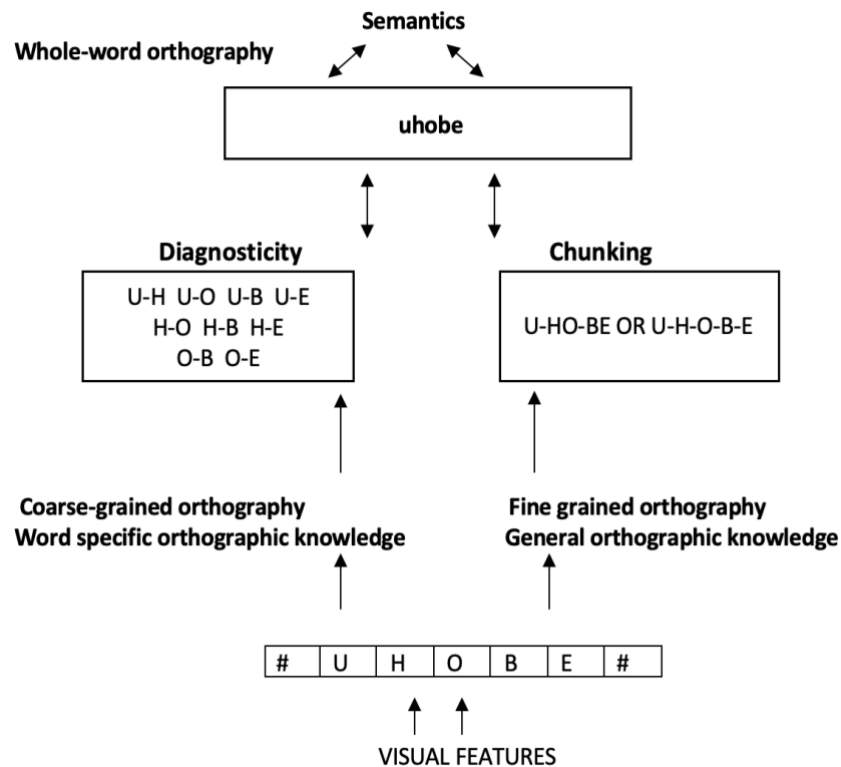


Figure 28: Adapted version of dual route model of orthographic processing (Grainger & Ziegler, 2011) based on thesis predictions

If we were to agree that the coarse-grained orthographic code provides an explanation of how word specific orthographic knowledge is processed when reading, and the fine-grained orthographic code offers an explanation for the processing of general orthographic knowledge as shown in Figure 28 above, then based on the findings of the thesis, it can be predicted that the grade 3 learners in the sample are utilizing both sub-lexical routes when processing orthographic information for reading in isiXhosa. This is premised on the fact that both word

specific orthographic knowledge and general orthographic knowledge were significant predictors of reading in the multiple linear regression model.

Grainger and Ziegler (2011) note that in order to maximize word identification, readers will need to access both diagnostic information (coarse-grained code) and information obtained from ‘chunking’ (fine-grained orthographic code). They acknowledge that the nature of a dual-route approach implies that there is a clear distinction between two routes, but they argue that the extent to which the two different routes are used when reading is dependent on the function that needs to be performed. Thus, their approach states that different orthographic codes are utilized to perform different functions when reading, supporting the argument that the readers in this sample are potentially using both routes when reading, but for varying functions. Word specific ($\beta=0.18$) and general orthographic knowledge ($\beta=0.16$) explained similar variance for reading in the multiple regression model, suggesting that they are indeed working in conjunction for reading, with word specific orthographic knowledge showing a slightly greater contribution, which could indicate that the learners use the coarse-grained orthographic code to a slightly greater degree for reading. This finding is in contrast to the initial hypothesis made in [section 2.5.2](#) that the fine-grained orthographic code would be the most utilised by isiXhosa learners due the rich morphology of the language.

The learners in this sample are poor readers, and thus it seems plausible that they would focus more on the distinct orthographic characteristics of words for reading rather than on the more precise information about the order and pattern of letter strings and the morpho-orthographic features. This is supported by the results of the quantile regression which showed that only word specific orthographic knowledge was predictive of reading at 0.5 quantile, and general orthographic knowledge was not found to be a significant predictor of reading at any level of tau.

While the model was not created to explain spelling development, if we were to extend the model’s theory to spelling, the findings would suggest the learners in the sample mainly utilise the coarse-grained orthographic code for orthographic processing, as word specific orthographic knowledge was found to be a robust predictor of spelling in the sample. As a follow up to these predictions, extended longitudinal empirical research should be conducted that further investigates orthographic processing in isiXhosa to understand reading development in the Southern Bantu languages better.

Grainier and Ziegler (2011) propose that the implications of their model include providing an explanation of how learners process orthographic information. They agree with the self-teaching hypothesis in that phonological recoding is a critical first step in reading acquisition (Share, 1995). However, they argue that during the process of phonological recoding, the likely exposure to printed text enables the setting-up of the parallel orthographic processing system hypothesized by their model. This differs from the premises of the self-teaching hypothesis which states that the relationship between phonological skill and orthographic knowledge is dependent on, rather than working in parallel to one another, as promoted by Grainger and Ziegler's (2011) approach. This provides supports the notion that PA is necessary, but not sufficient for orthographic knowledge development. If we follow the logic of Grainger and Ziegler (2011), this would extend to reading in that if PA is not sufficient for the development of orthographic knowledge, and orthographic knowledge is linked to reading, then PA would in essence also not be sufficient for reading development.

The following final chapter of this dissertation provides a summary of the main findings presented above.

CHAPTER 6: CONCLUSION

In this thesis I have provided an investigation into the nature of word specific and general orthographic knowledge in isiXhosa and their relationship to letter-sound knowledge, phonological awareness (PA), and rapid automatized naming (RAN). In addition, I have examined the contribution of word specific and general orthographic knowledge to reading and spelling while controlling for the above-mentioned metalinguistic skills. Further, in order to contribute to linguistic theory, I have provided a discussion of how the findings of this thesis can be positioned within the primary premises of the self-teaching hypothesis and the dual route approach to orthographic processing (Jorm & Share, 1983; Share & Jorm, 1987; Share, 1995; Grainger & Ziegler, 2011). These objectives were realized through the following four research questions.

1. What is the orthographic knowledge (word specific and general) of grade 3 isiXhosa home language learners?
- 2 a. What is the relationship between letter-sound knowledge, RAN (item and letter-naming), PA and word specific orthographic knowledge in grade 3 isiXhosa home language learners?
 - b. What is the relationship between letter-sound knowledge, RAN (item and letter-naming), PA and general orthographic knowledge in grade 3 isiXhosa home language learners?
- 3 a. What are the unique contributions of orthographic knowledge (word specific and general), letter-sound knowledge, RAN (item and letter-naming) and PA to reading in grade 3 isiXhosa home language learners?
 - b. What are the unique contributions of orthographic knowledge (word specific and general), letter-sound knowledge, RAN (item and letter-naming) and PA to spelling in grade 3 isiXhosa home language learners?
4. How can the findings from the above research questions be situated within the assertions of the self-teaching hypothesis and the dual route approach of orthographic processing?

This concluding chapter serves as culmination of the main findings of the thesis. The implications of the findings for isiXhosa pedagogy in South Africa are also addressed in this chapter. Lastly, closing remarks about the relevance of this research for the advancement of psycholinguistics of literacy research in African languages is discussed.

6.2.1. The measurement of orthographic knowledge in isiXhosa

The findings from this thesis indicate that the word specific and general orthographic knowledge tasks seem to be promising for use in other studies which may look at orthographic knowledge in isiXhosa or similar languages, for example, isiZulu and isiNdebele. This is indicated by the lack of floor or ceiling effects and the Cronbach alpha reliability analysis results, which showed that both tasks were reliable in both the pilot and main data collection phase. However, as the general orthographic knowledge task was found to be moderately reliable compared to word specific orthographic knowledge task which was found to be highly reliable, it is suggested that this task be revised for future use. It is also suggested that a confirmatory factor analysis should be conducted for both tasks to assess the validity of the instruments as this was not done in the current thesis.

In terms of learner performance on these tasks, the findings showed that the learners performed similarly on the word specific and general orthographic knowledge tasks, suggesting that these tasks are not distinct from one another enough to indicate statistical difference. The learners' average of approximately 58% on the word specific and general orthographic knowledge tasks is suggestive of a lack of a foundation in other metalinguistic skills which contribute to orthographic knowledge development; for example, PA and letter-sound knowledge, which were shown to be significant predictors of word specific and general orthographic knowledge in the regression analyses. The learners' poor performance on these tasks indicate a cumulative effect on their performance on the orthographic knowledge tasks.

6.2.2 Metalinguistic predictors of word specific and general orthographic knowledge

The findings indicated that letter-sound knowledge and PA were dominant predictors of both word specific and general orthographic knowledge, with letter-sound knowledge having the greatest effect in both models. RAN letter-naming was also found to be predictive of word specific orthographic knowledge. These results indicate that, for the most part, the same metalinguistic skills underlie word specific and general orthographic knowledge. However, the fact that only RAN letter-naming was predictive of word specific orthographic knowledge indicates that there may be differences in the development of these skills.

As an explanation for the relationship between PA, letter-sound knowledge, and word specific and general orthographic knowledge, it is proposed that PA is a necessary but insufficient skill

needed for orthographic knowledge development. Letter-sound knowledge reinforces PA with a written basis, which is needed for the conversion of sounds to graphemes that ultimately reinforces orthographic knowledge.

6.2.3 The role of word specific and general orthographic knowledge for reading and spelling

Both word specific and general orthographic knowledge predicted reading along with letter-sound knowledge and RAN item and letter-naming. However, only word specific orthographic knowledge was predictive of spelling, along with letter-sound knowledge. These findings support existing literature that shows orthographic knowledge is linked to reading and spelling (Adams, 1990; Templeton & Morris, 2000; Cunningham *et al.*, 2001; Ouellette & Senechal, 2008; Loveall *et al.*, 2013; Fleisch *et al.*, 2017; Zhao *et al.*, 2017; Zarić *et al.*, 2020) and confirm this relationship for isiXhosa. Quantile linear regression analyses showed that letter-sound knowledge was a robust predictor of reading, and that word specific orthographic knowledge was a robust predictor of spelling, as these variables were found to be significant at all levels of tau.

Another important finding was that letter-sound knowledge contributed the greatest variance in both linear regression models which predicted reading and spelling respectively. Existing research attests to the important role of letter-sound knowledge for early literacy development in alphabetic languages (Huang *et al.*, 2014). As these learners were indicated to be mostly poor readers (Ardington *et al.*, 2021), and relatively weak spellers, it is suggested that due to the transparent orthography of isiXhosa, these learners could be over-relying on the use of letter-sound knowledge in these languages for literacy development due their poor reading and spelling ability.

6.2.4 The findings in relation to the self-teaching hypothesis and the dual route approach to orthographic processing.

6.2.4.1 Self-teaching hypothesis

The findings of this thesis supports the one main premise of the self-teaching hypothesis, namely that there is a link between word specific orthographic knowledge and phonological skill (Jorm & Share, 1983; Share & Jorm, 1987; Share, 1995). However, the findings contradict the assertion that the relationship between word specific orthographic knowledge and

phonological skill is linear, and that word specific orthographic knowledge is an outgrowth of phonological skill, and not an independent skill (Jorm & Share, 1983; Share & Jorm, 1987; Share, 1995; Burt, 2006). The findings of this thesis showed that for this sample of isiXhosa grade 3 learners, word specific orthographic knowledge was found to contribute unique variance towards reading and spelling after controlling for PA. Thus, it is suggested that word specific orthographic knowledge and PA are linked, but that this does not necessarily imply that word specific orthographic knowledge is not an independent variable which contributes unique variance towards reading. These findings indicate that the nature of the relationship between PA and word specific orthographic knowledge for reading in isiXhosa might be more complex than explained by the self-teaching hypothesis. The findings presented warrant a deeper investigation of the self-teaching hypothesis in its explanation of reading for isiXhosa grade 3 readers. In particular, it is suggested that researchers conduct a mediation analysis which explores the argument that PA acts as mediator between word specific orthographic knowledge and reading, as well as considers the role of general orthographic knowledge in this relationship model.

6.2.4.2 Dual route approach to orthographic processing

The dual route approach to orthographic processing describes two fundamentally different kinds of orthographic sub-lexical routes used when reading: the coarse-grained orthographic code and the fine-grained orthographic code (Grainger & Ziegler, 2011). This thesis argues that the coarse-grained orthographic code represents the processing of word specific orthographic knowledge, and that the fine-grained orthographic code provides a partial explanation of the processing of general orthographic knowledge. An adapted model of the Dual Route approach to orthographic processing was proposed in [section 2.5.2 \(Figure 5\)](#).

Following this line of argument, it was suggested that the grade 3 learners in the sample are potentially utilizing both sub-lexical routes when processing orthographic information for reading in isiXhosa. This is premised on the fact that both word specific orthographic knowledge and general orthographic knowledge were significant predictors of reading in the multiple linear regression models. Seeing as the contribution of word specific and general orthographic knowledge to reading was quite similar, it seems plausible to suggest that they are indeed working in conjunction for reading, with word specific orthographic knowledge showing a slightly greater contribution, which could indicate that learners use the coarse-

grained orthographic code to a slightly greater degree for reading. However, these are tentative conclusions and would need to be confirmed with more robust evidence.

6.3 Pedagogical implications

The findings of this thesis can inform pedagogic practice in South Africa through providing a measure of orthographic knowledge that to my knowledge has not yet been developed within the South African context. This thesis presents the prospect for the development of measures of word specific and general orthographic knowledge for the Southern Bantu languages, as a means to limit methodological inconsistencies and to strengthen comparative analysis across studies. Furthermore, an assessment of this nature can assist educators and researchers in identifying at-risk learners for orthographic knowledge in isiXhosa. This is especially true as the results indicated that orthographic knowledge is important for both reading and spelling, and thus early identification of issues with orthographic knowledge can allow for early intervention which would ultimately enhance learners' educational trajectory.

It is clear from these findings that orthographic knowledge is important for reading and spelling in isiXhosa, and that PA and letter-sound knowledge are dominant predictors of both word specific and general orthographic knowledge. Therefore, learners should receive greater exposure to print materials, and there should be synchronous teaching of phonological awareness and letter-sound knowledge to enhance learners' orthographic knowledge which will in turn influence their reading and spelling ability. This can be achieved through phonics instruction, which includes both a verbal and written form of instruction, to allow learners to make the necessary connections between print and sound. Letter-sound knowledge was found to be the greatest contributor of reading and spelling, and as such greater emphasis needs to be placed on the teaching of letter-sound relationships. While phonics instruction is encouraged, it is important for educators to see phonics instruction as a map towards reading, and not the destination itself, as this knowledge needs to be built upon to create a solid foundation for both reading and spelling development. More research is needed into the development of phonics instruction which incorporates orthographic knowledge and other writing-related skills.

6.4 Closing remarks

There is a growing body of literature on the psycholinguistics of literacy in African languages. This research is dedicated to uncovering the micro-linguistic aspects of literacy in African

languages, and how it differs from the wealth of research on European literacy development. In light of this, I chose to focus on an under-researched variable of literacy in isiXhosa in order to contribute to this growing literature. Orthographic knowledge has never been explored with any African language, and thus the findings of this thesis are addressing a gap in the literature.

This thesis provided an investigation of orthographic knowledge and its role in literacy development in isiXhosa, and in doing so provides a well-considered and reliable measure of orthographic knowledge that can be used in other studies of a similar nature. Further, the findings showed that PA and letter-sound knowledge are dominant predictors of word specific and general orthographic knowledge for isiXhosa, with RAN letter-naming also predicting word specific orthographic knowledge. Further, both word specific and general orthographic knowledge were found to be predictive of reading alongside letter-sound knowledge and RAN. In addition, word specific orthographic knowledge and letter-sound knowledge were found to be predictive of spelling with word specific orthographic knowledge shown to be a robust predictor of spelling.

Lastly, the findings provide cross-linguistic support for one the main premises of the self-teaching hypothesis regarding the relationship between PA and word specific orthographic knowledge, but also present evidence for the support of the counter arguments regarding the nature of this relationship. Further, the findings provide evidence for the inclusion of more nuance in the dual route model of orthographic processing in its explanation of the relationship between the two sub-lexical routes and word specific and general orthographic knowledge.

Historically in literacy research, greater focus has been given to the reading aspect of language literacy. However, it is important to consider the written aspect of language literacy, and related metalinguistic skills, as this helps us to understand literacy development holistically. Reading and writing are inherently interrelated, and both spoken and written forms of language are essential for advancement in modern society and thus focus should be distributed equally. This study showed that orthographic knowledge plays a crucial role in conveying information for both reading and spelling in isiXhosa. This thesis is, to my knowledge, the first study of its kind, and thus provides a much needed platform for the greater exploration of the written aspects of language development in African languages and highlights possible avenues for future research within this scope.

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APPENDICES

1. IsiXhosa orthography-phonology correspondences (Diemer, 2015, pg.181-185)

Orthographic representation	Phoneme		
Single letters		r	[r]
		s	[s]
		t	[tʰ]
a	[a]	y	[u]
b	[b]	v	[v]
c	[ʃ]	w	[w]
d	[d]	x	[ʃ]
e	[e]	y	[j]
	[ɛ]	z	[z]
f	[f]	Two letters	
g	[g]	Digraphs	
h	[h]	bh	[bʰ]
	[h̥]	ch	[tʰ]
i	[i]	dl	[dʒ]
j	[dʒ]	dy	[dʒ]
k	[kʰ]	dz	[dʒ]
l	[l]	gc	[g]
m	[m]	gq	[!g]
n	[n]	gr (also a cluster)	[ɹ]
o	[o]	gx	[!g]
	[ɔ]	hl	[t]
p	[pʰ]	kc	[k]
q	[!]	kh	[kʰ]
kq	[k!]	qw	[!w]
kr (also a cluster)	[kxʰ]	sw	[sw]
mb	[mb]	xw	[lw]
mf	[mɸf]	gw	[gw]
mh	[mʰ]	lw	[lw]
mv	[mβv̄]	yw	[jw]
nc	[n]	zw	[zw]

nd	[nd]	Clusters with liquids [r] and [l]	
ng	[ŋg]	bl	[bl]
ng'	[ŋ]	br	[br]
nh	[n ^h]	dr	[dr]
nj	[ⁿ dʒ]	fl	[fl]
nk	[ŋk]	fr	[fr]
nq	[ŋ!]	gl	[gl]
nt	[ⁿ t']	gr (also a digraph)	[gr]
nx	[ŋl]	kl	[kl]
ny	[ɲ]	kr (also a digraph)	[k'r]
nz	[ⁿ dʒ]	sl	[sl]
ph	[p ^h]	tr	[tr]
qh	[! ^h]	Other clusters	
rh	[x]	sk	[sk]
sh	[ʃ]	st	[st']
th	[t ^h]	Three letters	
tl	[^h tl']	Trigraphs	
ts	[^h ts]	ndl	[ndʒ]
ty	[c']	ndy	[ɲ]
wh	[w ^h]	nkc	[nk]
xh	[! ^h]	ndy	[ɲ]
yh	[j ^h]	ndl	[ndʒ]
zh	[ʒ]	ngc	[ŋ!g]
Clusters with [w]		ngq	[ŋ!g]
cw	[!w]	ngx	[n!g]
dw	[dw]	nkc	[ŋk]
nw	[nw]	nkq	[ŋk!]

nkx	[ŋkl]	rhw	[xw]
ntl	[ntl̃']	shw	[ʃw]
nts	[nts']	skh	[sk ^h]
nty	[nc']	thw	[thw]
nyh	[n ^h]	tlw	[t̃l'w]
ths	[ts ^h]	tyw	[c'w]
tsh	[tʃ']	Other clusters	
	[tʃ ^h]	khr	[k ^h r]
tyh	[c ^h]	ndr	[ndr]
xhw	[lhw]	str	[st'r]
Clusters with [w]		Four letters	
chw	[l ^h w]	Quadgraphs	
ndw	[ndw[ntsh	[ntʃ']
dlw	[ɰw]	Clusters with [w]	
drw	[drw]	ndlw	[ndɰw]
ndw	[ndw]	ndyw	[ɲɰw]
dyw	[ɰw]	ngcw	[ŋɰgw]
gcw	[ɰgw]	ngqw	[ŋ!gw]
gqw	[!gw]	ngxw	[nɰgw]
gxw	[ɰgw]	nkcw	[ŋkɰw]
krw	[kxw]	nkqw	[ŋk!w]
ngw	[ŋgw]	nkxw	[ŋkɰw]
ncw	[nɰw]	ntsw	[nts'w]
ndw	[ndw]	ntyw	[nc'w]
njw	[ndɰw]	nyhw	[n ^h w]
nkxw	[ŋk'w]	tshw	[tʃ'w]
nqw	[ŋ!w]	tyhw	[c ^h w]
ntw	[nt'w]	Five letters	
nxw	[ŋɰw]	Cluster with [w]	
nyw	[ɲw]	ntshw	[ntʃ'w]
nzw	[ndɰw]		
qhw	[!hw]		

2. Consent form



RHODES UNIVERSITY
Grahamstown • 6140 • South Africa



Mzali obekekileyo

INCWADI YOKUZAZISA NESIVUMELWANO NOMZALI

Ndibhala ndicela imvume ukuba umntwana wakho abe nokuthatha inxaxheba kwinkqubo yolwimi lophando (Literacy task research) ephakathi kweCentre for Social Development (CSD) Rhodes University kunye neVolkswagen Community Trust (VWCT) yongenelelo lophando lwangaphambili, yecandelo lemfundo yabaqalayo (foundation phase) ukusukela kuGrade 1 - 3. Le nkqubo yongenelelo lophando lwangaphambili ijongana nohlolo lokufunda eye iqhutywe esikolweni somntwana wakho.

Sincedisa abafundi ngokuthi bazifundele ukuze baqonde, ingakumbi ngolwimi lwabo lweenkobe. Umfundi uvumelekile ukuba kunye nathi ngokunokwakhe kungekho kunyanzeleka. Nangaliphina ithuba engasafuni ukuqhubeka nathi akusayi kubakho salelo angayeka. Kwimisebenzi eyothi yenziwe kunye naye akukho nto iyakupapashwa enegama lomntwana wakho.

Uvumelekile ukuba ungabuza imibuzo kophetheyo, Nkosazana uNicci Hayes, nayiphina into nangaliphina ithuba ephathelele nesikhalazo, unga qhakamshelana naye ku n.hayes@ru.ac.za okanye kule nombolo 046-603 8573.

.....
.....

IPHETSHANA EMALIBUYE

Mna (igama lomzali, nceda ulibhale ngokucacileyo), ndiyifundile lengxelo ingentla. Ndiyavuma ngokukhululekileyo ukuba umntwana wam angathatha inxaxheba CSD/VWC) yongenelelo lophando lwangaphambili. Ndiyathemba ezozinto bakuzenza nani zakugcinwa zingaziwa.

.....
Umzali asayine

.....
Umhla

Igama lomntwana

Igama lesikolo

Igama likatitshala

3. Ethical clearance certificate



Human Ethics subcommittee
Rhodes University Ethical Standards Committee
PO Box 94, Grahamstown, 6140, South Africa
t: +27 (0) 46 603 8055
f: +27 (0) 46 603 8822
e: ethics-committee@ru.ac.za

www.ru.ac.za/research/research/ethics
NHREC Registration no. REC-241114-045

13/11/2020
MS Tracy Probert
School of Language & Linguistics Email: T.Probert@ru.ac.za
Review Reference: 2020-1195-3307

Dear Ms Tracy Probert

Title: VWCT Legacy Literacy Project: Investigating literacy skills in Kwanobuhle Foundation Phase learners

Principal Investigator: Ms Tracy Probert

Collaborators: , Ms Nicci Hayes, Ms Mikaela Daries

This letter confirms that the above research proposal has been reviewed and **APPROVED** by the Rhodes University Human Ethics Committee (RU-HEC). Your Approval number is: 2020-1195-3307

Approval has been granted for 1 year. An annual progress report will be required in order to renew approval for an additional period. You will receive an email notifying when the annual report is due.

Please ensure that the ethical standards committee is notified should any substantive change(s) be made, for whatever reason, during the research process. This includes changes in investigators. Please also ensure that a brief report is submitted to the ethics committee on the completion of the research. The purpose of this report is to indicate whether the research was conducted successfully, if any aspects could not be completed, or if any problems arose that the ethical standards committee should be aware of. If a thesis or dissertation arising from this research is submitted to the library's electronic theses and dissertations (ETD) repository, please notify the committee of the date of submission and/or any reference or cataloging number allocated.

Sincerely,

Prof Arthur Webb

Chair: Rhodes University Human Ethics Committee, RU-HEC cc: Mr. Siyanda Manqele - Ethics Coordinator

4. Word specific orthographic knowledge task marking sheet

TASK 1 - WORD SPECIFIC ORTHOGRAPHIC KNOWLEDGE TASK

Start time:

End time:

INSTRUCTION FOR LEARNER : Tell the learner that they will be shown a list of words that are incorrectly spelled and that there is one letter in each word that makes the word incorrectly spelled. Thereafter, ask the learner to point to the letter that makes each word incorrectly spelled.

INSTRUCTION FOR LITERACY AMBASSADOR: Read the above instruction to the learner. Go through the two practice examples with the learner showing them how to complete the task. You can provide corrective feedback but only for practice examples. Do not read aloud the item words to the learner at any point. The learner needs to physically point to the incorrect letter and you then need to indicate what letter they pointed to below. Please make sure that the learner understands that they only need to point to one letter.

Practice examples	Correct answer	Correct letter to be removed
1. uthata	utata	'h'
2. wenya	wena	'y'

Scoring:
Correct = 1
Incorrect = 0
Nonresponse = NA

Items	Answer	Score	Comments
1 zonkhe			
2 ingja			
3 nxceda			
4 borna			
5 iminyi			
6 kwuphela			
7 ingcwadi			
8 umhlabaa			
9 amangama			
10 encinanje			
11 aamazinyo			
12 ambafundi			

5. General specific orthographic knowledge task marking sheet

TASK 2 – GENERAL ORTHOGRAPHIC KNOWLEDGE TASK

Start time:

End time:

INSTRUCTION FOR THE LEARNER: Tell the learner that they will be shown three words but only one of the three words is a real isiXhosa word that they could find in an isiXhosa book. Thereafter, ask the learner to point to the one word that looks like the real isiXhosa word in the three words.

INSTRUCTION FOR LITERACY AMBASSADOR: Read the above instruction to the learner. Go through the two practice examples with the learner first showing them how to complete the task. You can provide corrective feedback but only for practice examples. Present each set of item words to the learner separately. Indicate below what word the learner points to during the assessment. Please do not read the item words to the learner at any point.

Practice examples	Correct answer
1. thena vs. htena vs. theena	thena
2. lekgoso vs. legoso vs. legosbo	legoso

Items	Correct answer	Correct	Answer if incorrect	Comments
1. dethu vs. mdethu vs. denthu	dethu	<input type="radio"/>		
2. wacx vs. waca vs. wacka	waca	<input type="radio"/>		
3. katsho vs. kathso vs. katzo	katsho	<input type="radio"/>		
4. phend vs. phedni vs. phendi	phendi	<input type="radio"/>		
5. tyhiphive vs. thyiphive vs. tydliphive	tyhiphive	<input type="radio"/>		
6. dwasepe vs. wasepe vs. watshepe	wasepe	<input type="radio"/>		
7. belezwi vs. belezywi vs. nbelezwi	belezwi	<input type="radio"/>		
8. omdawo vs. ondawo vs. ondwawo	ondawo	<input type="radio"/>		
9. dlenqhwolaba vs. dlenqhwrolaba vs. dlenrhoqwoba	dlenqhwolaba	<input type="radio"/>		
10. ndoxelecha vs. ndoxelecha vs. ndodyhalecha	ndoxelecha	<input type="radio"/>		
11. cwalabane vs. mcwalabane vs. cxwalabane	cwalabane	<input type="radio"/>		
12. intshwalena vs. intchwalena vs. inthcwalena	intshwalena	<input type="radio"/>		
			Total	/ 12

6. Oral reading fluency passage

UHobe noMbovane

Ngenye imini kwakushushu kakhulu. uMbovane kunye noHobe babehleli emthunzini womthi.

“Ndinxaniwe!” wakhwaza uMbovane.

“Kutheni ungayi kusela amanzi emlanjeni nje?” waphendula uHobe kumthi okufuphi.

“Ulumke ungaweli ngaphakathi.”

Wabaleka uMbovane ukuya emlanjeni waza waqalisa ukusela. Ngephanyazo umoya omkhulu wamvuthelela uMbovane emanzini. “Ncedani!” Wakhala uMbovane.

“Ndiyeyela!” UHobe waqonda ukuba kufanele ancede uMbovane ngokukhawuleza. UHobe waqhawula igqabi emthini, wabhabha phezu kwamanzi waze wawisa igqabi emanzini. UMbovane wakhwela phezu kwegqabi waze wahamba namanzi ngokukhuselekileyo ukuya emhlabeni owomileyo.

7. PA task marking sheet

UMSEBENZI 2 IMVAKALO NOKUQONDWA KOKUSETYENZISWA KOONOBUMBA NEZANDI

Xelela umntwana ukuba nizakudlala umdlalo ngezandi ezisemagameni kunye nowokophulwa kwamagama. Funda umzekelo obhaliweyo kuqala ukwenzela ukuba umntwana akwazi okulindelekileyo kuye

- unakho ukulifunda igama kwakhona kodwa ungamngxameli umntwana.

Item				Correct	Incorrect	No response	Correct form
Phoneme Identification – small sounds							
1.	Ndibizele eligama	<i>hleka</i>	Liqala ngesiphi isandi eli gama	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	/hl/
2.	Ndibizele eligama	<i>bona</i>	Sithini isandi sesibini kweli gama	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	/o/
3.	Ndibizele eligama	<i>kuqala</i>	Sithini isandi sokugqibela kweli gama	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	/a/
Phoneme Deletion - small sounds							
4.	Ndibizele eligama	<i>vuka</i>	Libize kwakhona eligama ususe u /v/	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	uka
5.	Ndibizele eligama	<i>kodwa</i>	Libize kwakhona eligama ususe u /k/	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	odwa
6.	Ndibizele eligama	<i>umfundi</i>	Libize kwakhona eligama ususe u /f/	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	umundi
Syllable Identification – big sounds							
7.	Ndibizele eligama	<i>ngathi</i>	Liqala ngesiphi isandi eli gama	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	/nga/
8.	Ndibizele eligama	<i>kwafika</i>	Libize isandi sesibini kweli gama	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	/fi/
9.	Ndibizele eligama	<i>abahlobo</i>	Libize isandi sokugqibela kweli gama	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	/bo/
Syllable Deletion – big sounds							
10.	Ndibizele eligama	<i>yatsho</i>	Libize kwakhona eligama ususe u /ya/	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	tsho
11.	Ndibizele eligama	<i>ngaphandle</i>	Libize kwakhona eligama ususe u /ndle/	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	ngapha
12.	Ndibizele eligama	<i>kufanele</i>	Libize kwakhona eligama ususe u /ku/	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	fanlele
Total correct							

8. RAN item and letter-naming tasks instruction and marking sheet

Rapid Automated Naming (RAN): IZINTO

Show practice page (Chart 4.1) and say, **Ziintoni ozibona kweli phepha?** (point to first object and continue pointing if necessary. If the child makes any errors, correct the child, and have him/her repeat all the objects again (e.g. inkwenkwezi, isandla, itafile,inja, incwadi, ilanga). Say, **Uza kubiza amagama ezinto ozibonayo ukhawulezisa kangangoko unako.**

Show (Chart 4.2.) and say, **Masiyizame. Xa ndisithi qalisa, uza kuqala apha, ubize amagama ezinto ezi kule rowu ngaphambi ngokuba udlulele kwelandelayo. Biza igama le nto ekwirowu nganye ukhawulezisa kangangoko unako de uyofika ekugqibeleni. Zama ukuba ungatsibi nanye into. Uyaqonda?**

Put a blank sheet on top of Chart 4.2 to cover the objects for about 5 seconds. Say, **Uza kuqalisa xa ndityhila iphepha. Sowulungile? Qalisa.** Quickly take blank sheet off Chart 4.2, and start timing as soon as the child says the first object's name. Stop timing when the name of the last object is pronounced. Keep track of errors by circling each wrong item. When the child is finished, record time and errors.

Number of objects sounded incorrectly	
Time to complete task	

Rapid Automated Naming (RAN): IILETA

Show practice page (Chart 4.3.) and say, **Ngabaphi oonobumba obabonayo kweli phepha? Sesiphi isandi esenziwa ngunobumba ngamnye?** (point to first letter and continue pointing if necessary. If the child makes any errors, correct the child, and have him/her repeat all the letters again.) Say, **Uza kube ubiza izandi zabanye oonobumba ukhawulezisa kangangoko unako.**

Show (Chart 4.4) and say, **Masiyizame. Xa ndisithi qalisa, uza kuqalisa apha ubize izandi zaba nobumba bakule rowu ngaphambi kokuba udlulele kwirowu elandelayo. Vele ubize izandi zoonobumba kwirowu nganye ukhawulezisa kangangoko unako de uyofika ekugqibeleni. Zama ukuba ungatsibi nomnye unobumba. Uyaqonda?**

Put a blank sheet on top of Chart 4.4 to cover the letters for about 5 seconds. Say, **Uza kuqalisa xa ndityhila iphepha. Sowulungile? Qalisa.** Quickly take the blank sheet off Chart 4.4, and start timing as soon as the child says the first letter's sound. Stop timing when the name of the last letter is pronounced. Keep track of errors by circling each wrong item. When the child is finished, record time and errors.

Number of letters sounded incorrectly	
Time to complete task	

9. Letter-sound knowledge task marking sheet

UMSEBENZI 1 OONOBUMBA NEZANDI
Imizekelo: b M f ts a

S	v	n	g	L	y	Z	h	W	m	/10
k	th	G	b	c	hl	i	d	z	a	/20
p	nd	z	U	ng	sh	j	kh	X	u	/30
q	sw	B	qh	i	f	e	Z	R	I	/40
S	n	lw	ndl	t	Y	ts	bh	nc	E	/50
y	tsh	Q	ph	M	v	O	t	ny	P	/60
dl	A	e	mp	f	ph	h	u	A	r	/70
W	dw	H	b	nz	q	dl	m	hl	q	/80
L	o	lw	a	X	ntl	E	ny	p	x	/90
N	kw	nc	D	ndl	y	mb	j	C	mv	/100
V	ncw	W	q	V	h	ndl	g	tsh	y	/110
Make a tick mark (✓) and a comment if task was discontinued because learner couldn't read										
Number of sounds read in 1 minute										
Number of sounds read incorrectly										
Total number of sounds read correctly /110										
If task completed in less than one minute, indicate total seconds										
Number of correctly identified complex graphemes										

10. Rmarkdown of data analysis

The Rmarkdown of the data analysis for this thesis can be accessed via request from the following link:

https://drive.google.com/file/d/1Nodt719f5CzPniXeW_MA4kzGA1fJ9htA/view?usp=sharing