THE CONTRIBUTIONS OF PHONOLOGICAL AWARENESS AND NAMING SPEED TO THE READING FLUENCY, ACCURACY, COMPREHENSION AND SPELLING OF GRADE 3 ISIXHOSA READERS

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

MASTER OF ARTS

of

RHODES UNIVERSITY

by

MAXINE NICHOLE DIEMER

December 2015

ABSTRACT

This thesis contributes to reading research in isiXhosa, where the role of various cognitive skills in reading has not yet been examined. One of the current debates in reading research centers on the contribution of cognitive skills, namely phonological awareness and naming speed, to reading. The exact relation between phonological awareness and naming speed, and their relation to literacy in different languages are also disputed. In this study, the contribution of phonological awareness and naming speed to literacy is examined in 52 Grade 3 isiXhosa speaking children. Measures for literacy included oral reading fluency, silent reading, comprehension and spelling. Phonological awareness was the biggest contributor to reading fluency, accuracy, comprehension and spelling, confirming that phonological processing is important for reading in all languages studied to date. The role of naming speed was narrower, contributing to the fluency and accuracy of reading only in the group with poor phonological awareness. The results can inform the teaching of reading isiXhosa where an approach that explicitly emphasises orthography-phonology relations at the phoneme level may be well suited especially since there are many letter groups to learn. This would enable higher accuracy in orthography-phonology correspondences and should also improve automaticity, which was lacking in the group with low levels of phonological awareness. The Psycholinguistic Grain Size Theory of reading can adequately inform the understanding of reading in isiXhosa, and findings from other languages with similar requirements can inform the teaching of reading in isiXhosa.

ACKNOWLEDGEMENTS

This thesis is the final product of two long years of work, but it was not a solitary project. I am grateful to a number of people for their influence and help, both financial and academic.

In the first place, my thanks go to Will Bennett for being unarguably the best supervisor. Not only did he set a good example in the own research he does, but he understood my circumstances and was always there to give an encouraging word, even if he parodied my accent when he did it. I extend my gratitude to Mark de Vos who heard me out when I was at a pivotal moment in analysing my data, and gave me wise advice. I had an enriching opportunity to work as part of the larger Sandisa Imbewu Literacy project in the Linguistics Department. I worked with the project leaders, Mark de Vos and Kristin van der Merwe, and I thank them for allowing me to develop my independent research skills in conjunction with other researchers. My thanks go to my colleagues Tracy Probert and Sian Rees for the team effort in data collection. I would also like to thank my colleague, Kelly Shiohara, for comments made on an early draft of Chapter 4.

I extend my sincere gratitude to the principals, heads of department, teachers and learners who participated in this study, without your willingness I would not have anything to report on. Data collection would not have been possible without our excellent and dedicated research assistants and translators: Sibusiso Klaas, Lifa Ntenteni, Noziphiwo Bacela, Sinesipho Mbusi, Bantubonke Ntsaluba, Tolakele Silo, Zipporah Madiane, Yonela Pipile, and Fuzile Koyana.

The experience of writing a thesis could not be complete without the accompanying drama from colleagues in the same position. I thank Justine Kerford, Tracy Probert, Gwyn Ortner, Sian Rees and Stefan Savić for all their antics in the department. You were all there to keep me sane, and sometimes to drive me insane. Of course, I am very grateful to my family who all supported me at university, both emotionally and financially. My sister Giselle deserves special thanks for her involvement in helping me stay focussed and keeping me on track. Finally, my fiancé, Mark Schaefer must be acknowledged for his unwavering support and the countless hours he spent reassuring me that “yes, you can do it”, and now I have done it.

For financial assistance, thanks go to The Rhodes University Prestigious Scholarship and The Sandisa Imbewu Literacy Project. Opinions expressed and conclusions arrived at, are those of the author and are not necessarily to be attributed to Rhodes University or the donors.

I would finally like to thank the two examiners of this thesis for their fair comments and active engagement with the contents of the thesis. Your questions and suggestions have surely improved the quality of this thesis, and have made me a better researcher. For this, I am most grateful.

CONTENTS

LIST OF TABLES AND FIGURES

TABLES

FIGURES

LIST OF ABBREVIATIONS

CAPS	Curriculum Assessment Policy Statement
DBE	Department of Basic Education
DDH	Double Deficit Hypothesis
M	Mean
NS	Naming Speed
ODH	Orthographic Depth Hypothesis
PA	Phonological Awareness
PGST	Psycholinguistic Grain Size Theory
RAN	Rapid Automatized Naming
SD	Standard Deviation

1 INTRODUCTION

1.1 Introduction

This dissertation presents the findings of a cross-sectional study used to determine the contribution of phonological awareness and naming speed to various reading variables in isiXhosa. In this introductory chapter I contextualise my study theoretically and place it in the South African educational context. I also provide an introduction to the research questions, aims and methods used in this study, before outlining the major conclusions. Finally, I introduce the organisation of the thesis.

1.2 Background to the research

The research presented in this thesis adds information to two areas: 1) theoretical knowledge about the skills involved in reading in different languages, and 2) evidence based reading instruction which is linguistically sound for isiXhosa.

A number of disciplines inform the field of reading research (including but not limited to education, psychology, sociology, anthropology, cognitive science, neuroscience and linguistics), each of which bring their own focus, methods and interpretations. For the most part, the perspectives from each discipline remain isolated resulting in a "politicised, contested and fragmented" field (Pretorius 2010: 342). Bringing the findings and interpretations from all these fields together is out of the scope of this thesis. Rather, the focus of my thesis is to insert a linguistic perspective on the predominance of psychological research on reading acquisition and skilled reading. I take a componential view of the reading process, viewing reading as a bottom-up process which involves a number of linguistic, cognitive, and perceptual processes. I address the roles of phonological awareness and naming speed, skills involved in the word recognition phase of reading, in a language in which their relationship has not yet been explored, isiXhosa.

A number of reading theories have been based on readers of English. Evidence has indicated, however, that the theoretical understanding of reading, which works for English, may not always explain reading in other languages. This calls into question the suitability of English informed theories for explaining reading in other languages (Share 2008). Out of this critique, many cross-linguistic studies have been published which provide evidence that, to a certain extent, the same skills are involved in reading in all languages, but depending on the way the language is written down, the strength of the relationship might vary. It is now mostly accepted that phonological processing is of utmost importance for successful literacy acquisition (Goswami 2009).

The psycholinguistic skill most involved in phonological processing for reading is phonological awareness (PA). This is the sensitivity to the sounds and sound structure of one's language (Anthony *et al*. 2003). PA is necessary for readers to understand the alphabetic principle: that letters on the page represents sounds in the language (Liberman *et al*. 1989), which is in turn necessary to develop letter-sound mappings needed for decoding. Another skill which has been implicated in reading, but may not necessarily be categorised only as part of phonological processing, is naming speed (NS). NS, as measured by a serial naming task, is the time taken to read a set of very familiar stimuli such as numbers or letters (Kirby *et al*. 2010). However, what the speed of naming these stimuli is an indicator of is yet to be decided (Georgiou & Parrila 2013). NS has also been shown to predict reading even after accounting for PA, and has been implicated as a second independent variable related to reading dysfunction (Georgiou & Parrila 2013). These two skills and how they relate to reading have never been examined together in isiXhosa.

There are a number of reading theories which seek to explain how phonological processing is used for reading. These theories make different claims which lead to different predictions for reading. For example, the Orthographic Depth Hypothesis (ODH) (Katz & Frost 1992) proposes two routes to reading which are encouraged by the transparency of the orthography. The Psycholinguistic Grain Size Theory (PGST) (Ziegler & Goswami 2005, 2006), on the other hand, proposes a single phonological route; consequently PA is of utmost importance to this theory. PGST also explicitly emphasises the role of the development of phonological awareness for reading acquisition, which leads to skilled reading, stating that an understanding of PA and reading is of utmost importance. However, the theory does not adequately address the role of NS, identified to be important by other researchers, and its contribution to reading fluency. The Double Deficit Hypothesis (DDH) (Wolf & Bowers 1999) proposes that low levels of both PA and NS are responsible for dyslexia. The DDH emphasises the importance of both PA and NS, whereas PGST places emphasis only on PA. These theories can be criticised for explaining only English reading, not addressing the role of NS adequately, and explaining only reading or dyslexia, respectively. There is therefore a gap in the literature. In my study I focus primarily on including the predictions of the Double Deficit Hypothesis (with an added emphasis on NS) in the Psycholinguistic Grain Size Theory in order to explain skilled reading in isiXhosa.

Returning to a more local background, there are few studies which have been conducted on the micro-linguistic aspects of reading in the official languages of South Africa, with the exception of English and Afrikaans (de Vos *et al*. 2014, van Dulm & Southwood 2015). This means that there is minimal research on how literacy is acquired in these languages, and therefore little language-specific research informing literacy instruction in the foundational grades. This lack of language-specific research has a negative impact on the quality of literacy instruction guidelines. For example, the current Curriculum Assessment Policy Statement (CAPS) document (DBE 2011) does not outline an adequate sequence of phonics instruction because the document has translated the English curriculum for isiXhosa, instead of being based on the requirements of isiXhosa reading (de Vos *et al*. 2014). Another consequence of this lack of research is that there are no standardised screening or diagnostic tests that can be used for identifying at-risk readers in isiXhosa (Pretorius 2002, van der Merwe & Roux 2014).

The second reason for conducting this research then is to inform evidence based literacy instruction, by determining which variables are important for reading in isiXhosa. If the findings demonstrate that theories of English do predict reading in isiXhosa then this is evidence that existing English pedagogy can be adapted for isiXhosa. However, if there is a different predictive pattern of these variables, then this is evidence that more research is needed to better understand reading in isiXhosa. Because there are no tests available, this means that I have to develop them based on other researchers' methods. There is therefore also a need to determine the best or even adequate ways of measuring the variables in my study.

Finally, the need for evidence based research is warranted to increase the quality of basic literacy education in South Africa, specifically in the non-English official languages (de Vos *et al*. 2014). A report by the Department of Basic Education (DBE) (2010) on the languages used in education between 1998 and 2007 shows a steady increase in the number of learners who learn in an African[1] language in the Foundation Phase, with a similar increase in the number of learners learning in either English or Afrikaans in the later grades. While English literacy acquisition is very well researched, literacy research in the other official South African languages is scarce (de Vos *et al*. 2014). Importantly, in 2007, 80% of learners across South Africa were learning in their first language, which is an improvement over the decade from 55% in 1998. However, the DBE (2010) asks the question why this match between home language and LOLT has not translated

[1] The DBE does not include Afrikaans in the list of African languages.

into better achievement, considering that there is a large body of research which provides evidence for the benefit of learning in one's home language.

Perhaps, these low levels of achievement are also rooted in a lack of research on the intricacies of literacy acquisition, or the requirements for successful reading, in these non-English languages. Indeed, de Vos *et al*. (2014) report that in instances the English curriculum is translated for use in the African languages, because of a lack of understanding on how the differences in the languages may affect how literacy is instructed, or as a consequence of no research being available. Of course, the influence of other factors such as socio-economic status, school resources, teacher education and other factors may also play a role.

In summary, from a theoretical perspective, there is a need to examine reading, and the skills which underlie it, in a variety of languages in order to develop a better understanding of reading cross-linguistically, thereby informing reading theories and literacy instruction. A better understanding of the skills involved in reading, and how to measure them in isiXhosa may also help speech pathologists and educational psychologists who make use of diagnostic and screening tests to identify children at risk for reading failure, as well as help educators with teaching instruction. A substantial part of my thesis addresses the development of the tasks used in this study in order to pave the way for future researchers who could develop standardised measures. I specifically address the contributions of NS and PA to reading accuracy, fluency, comprehension and spelling in isiXhosa. The findings can then be used to inform the teaching of reading in isiXhosa. These issues are addressed through answering my research questions.

1.3 Research Questions

The main aim of this study is to determine the contributions of phonological awareness and naming speed to reading accuracy, fluency, comprehension and spelling in isiXhosa, in order to expand on the suitability of the Psycholinguistic Grain Size Theory for explaining reading. The research questions answered of this study are presented below:

1. What are the phonological awareness levels of Grade 3 isiXhosa readers?
    a. What linguistic aspects of isiXhosa, or other factors, affect phonological awareness in isiXhosa?
    b. How best can phonological awareness be measured in isiXhosa?
2. What is the relationship between phonological awareness and naming speed in isiXhosa?

3. What is the contribution of phonological awareness and naming speed to reading fluency, accuracy, comprehension and spelling in isiXhosa?
    a. How do these findings relate to the predictions of current reading theories?
    b. Based on 3a, do adaptations need to be made to the PGST's conceptualisation of reading?

The first research question addresses PA in isiXhosa. An in-depth analysis of PA is warranted because of the emphasis placed on it by PGST. Because research in this field is limited, the PA tasks were developed from a previous study on isiXhosa (Diemer *et al*. 2015), and those measures created for other languages (e.g. Wilsenach 2013, Moll *et al*. 2014). For this reason, the sub-questions tease out the factors which may affect performance on this task in order to determine if this was an adequate way of measuring PA in isiXhosa. In order to avoid multicollinearity in the multiple regression used in this study, the correlations of the two independent variables, PA and NS, are determined to answer research question 2.

For research question 3, the independent contributions that NS and PA make to the dependent variables (reading accuracy, fluency comprehension and spelling) in isiXhosa are teased out. Second, these findings are compared to the literature presented in Chapter 2. Finally, the comparison informs whether there is a need to change or adapt PGST to better explain reading in isiXhosa.

1.4 Method

This quantitative cross-sectional study reports on the data of a convenience sample of 52 isiXhosa speaking Grade 3 children from three schools who completed the five tasks developed for this study. Tasks were administered to participants over two sessions, with at least one day and not more than one week between sessions. The research for this thesis was conducted as part of a larger research project in the Linguistics Department, so there were constraints on time as a number of researchers were administering different tests in the same session. Testing was done in the third and fourth school terms of 2014, and in the case of the spelling task in March 2015.

Five tasks were developed for this study in order to measure the independent variables (NS and PA) and dependent variables (reading fluency, comprehension and spelling). The reading, comprehension and NS tasks were administered in the first session and the PA task was administered in the second session. The spelling task was administered to a small sample of learners sampled in 2014. The tasks are outlined below. Chapter 3 addresses the development of each task in more detail.

In order to measure PA, a battery of sub-tasks was created which required participants to segment, identify and delete syllables and phonemes in nonwords (nonsense words which follow the phonological constraints of isiXhosa) in an untimed condition. The scores were combined to create scores for Segmenting, Identification and Deletion. Only Deletion was used in the multiple regression models since this is the most common PA task reported in the literature (Ziegler *et al.* 2010, Moll *et al.* 2014). Because of a bimodal distribution in the Deletion scores, participants were split into two groups of equal sizes. NS was measured with a rapid serial naming task which required participants to name a set of visually presented numbers out loud in isiXhosa for 15 seconds. The number of items read was converted into an Items per Second score and used for later analysis.

Reading fluency was measured in silent and oral conditions and was timed. Participants read one passage orally and one passage silently, each for one minute. In the oral condition, their errors were recorded and subtracted from the total number of words read. This score was converted into a Words Correct per Minute score. In the silent condition, participants indicated their speed of reading by placing their finger underneath the word, which was tracked by the administrator. The last word indicated at the end of the minute was used to calculate the Number of Words Attempted. The Words Correct per Minute score and the Number of Words Attempted was averaged to provide a Reading Fluency score, for use in later analysis. An Accuracy score was also calculated for the oral task for use in later analysis. Finally, a comprehension task of five questions measuring predominantly literal comprehension followed each passage. Participants responded orally. The number of correct responses was tallied. The scores from the comprehension measures were averaged to provide a Comprehension score used for later analysis.

Forward stepwise regressions were run to determine the individual contributions of NS and PA to the reading variables. These results are presented for the whole sample (acknowledging the violation of normality), Group 1 and Group 2. The research questions are addressed with reference to the differing contributions of the predictor variables (PA and NS) in each group.

1.5 Structure of the thesis

This chapter has laid the foundation that the remainder of the thesis rests on by outlining the argument I make about the contribution of PA and NS to various reading abilities in reading isiXhosa in Grade 3.

From a theoretical standpoint I highlighted that there are two reading theories which I will focus on, PGST and DDH, which make different predictions about reading and theorise differently on the processes which underlie reading. I argued that there is a gap in the PGS Theory because it does not adequately addresses both the role of NS and PA in reading. Secondly, these skills have not yet been examined in isiXhosa. I also highlighted that in South Africa there is a need for linguistically informed evidence based research on the processes which underlie reading in African languages which can be used to inform literacy instruction. This argument is addressed in Chapter 2 where I outline and evaluate the literature that is relevant to my study.

In Chapter 3, I address how I developed the measures used in this study. Unlike English, isiXhosa has no standardised tests available for any of the constructs I sought to measure. Chapter 3 therefore details exactly how I developed the tests. Each measure is also included as an appendix. I have been transparent in the development of the tests for two reasons. Firstly, transparency ensures that the tasks can be evaluated for best practice. Secondly, there is a need to move towards standardised measures, especially because PA and NS have been shown to be good predictors of reading ability.

Chapter 4 presents the results and discusses what these results show in relation to the research questions. After the descriptive statistics are presented, each research question is addressed in the order they were asked. The PA task is addressed in great detail in order to determine the language specific and orthographic influences on PA. The bimodal distribution found in the Deletion scores is addressed by splitting the participants according to the types of errors they make on the tasks. As a result the answers to the remaining research questions are determined by examining the data for the whole sample, and for each sub-sample. The relationship between PA and NS informs (Research Question 2) the use of the forward stepwise regressions used to answer Research Question 3. The roles of PA and NS are examined for the whole sample and each sub-sample for reading fluency, accuracy and comprehension. A forward stepwise regression is also run for the group who were administered the spelling test. Throughout this chapter, comparisons are made to the literature reviewed in Chapter 2, which informs suggestions for improving the reading theories. I also highlight areas where more research is warranted to better understand the processes.

Finally, Chapter 5 concludes the argument by summarising the main findings of the thesis. These are assessed in light of the contribution they make to the measurement of the variables, reading theories, and their relevance to South African education. Avenues of further research are also suggested.

2 THEORETICAL OVERVIEW

2.1 Introduction

The chapter provides an overview of the literature concerning reading and its underlying components, as relevant to this study, and highlights the gap that my study fills. This chapter draws on influential work in the reading field to contextualise the study in theory, and draws on recent work to outline the current developments and debates in the reading field. This chapter first outlines the view on reading taken in this dissertation (§2.2). The influence of orthographic transparency on reading is expanded in §2.3. The linguistic description of isiXhosa leads to the conclusion that it is written relatively transparently (§2.4). §2.5 provides an overview of current reading theories and outlines that phonological processing conceptions of reading are most popular but that a second emphasis, on that of naming speed, has gained interest. The two psycholinguistic variables of interest in the study, phonological awareness and naming speed, are highlighted in the discussion on reading theories (§2.5) and are addressed in more detail in §§2.6 and 2.7 respectively. The available literature on literacy in isiXhosa and similar languages is presented in §2.8. The reviewed literature highlights gaps in knowledge about reading in isiXhosa, which are highlighted by the research questions presented again in Chapter 3.

2.2 The acquisition of reading

Learning how to read is learning how to make meaning from writing. Since writing represents sounds of the spoken language to varying degrees it is not unexpected that factors involved in oral language processing are involved in reading acquisition (Bolger *et al*. 2005, Goswami 2009). However, having a good understanding of oral language is not enough to learn how to read (Adams 2011). Unlike the ability to speak, the ability to read is a skill that must be taught and learned (McGuinness 2005).

Reading consists of two major processes: the successful recognition of words, and comprehension of the text, both of which involve a number of processes. In the first place, reading involves the visual recognition of the word in the visual word form area of the brain. This part of the brain develops with reading practice and is specialised for recognising letters and words (Adams 2011). After the word is recognised, the brain processes the orthographic combinations to match them to their phonological representations. The word is then recognised and the reader retrieves its meaning in the context of the text by using semantic, syntactic and morphological processing (Kirby *et al*. 2010). Reading therefore relies on all aspects of oral language necessitating the processing of phonology (Wagner & Torgesen 1987), morphology

(Carlisle 2003), and syntax (Chard *et al*. 2000), as well as the added processing of orthography (Aro 2004). Early literacy instruction focuses on developing word recognition in meaningful contexts, but as readers progress through school, the emphasis is placed on comprehension and 'reading to learn' (Howie *et al*. 2008).

The Orthographic Depth Hypothesis (addressed further in §2.5.1) argues that word recognition takes place via two routes: either by recognising the whole word visually, or by decoding the individual letters in words and generating their sounds (Katz & Frost 1992). Whole word recognition is further addressed in §2.5.1. Decoding, also called phonological recoding, is the process of matching the orthographic word to its phonological representation (Share 1995) (Adams 2011). It therefore relies on the reader having (1) letter knowledge, (2) an understanding of grapheme-phoneme (letter-sound) correspondences in the language being read, and (3) sensitivity to the sound structure of their language (phonological awareness) (Adams 2011). For words which do not follow the expected letter sound correspondences of the writing system, some words may be visually recognised as wholes i.e. visual or whole word recognition.

Phonological recoding as a route to word recognition develops slowly as the reader is introduced to letters, and grapheme-phoneme correspondence rules. Beginner learners read slowly and inaccurately while they are learning to decode. This may impair comprehension because much attention is given to recognising the words through laborious decoding (Rasinski & Samuels 2011). However, as readers practise reading, word recognition becomes more fluent (increasing in speed and accuracy) as readers decode automatically and read with expression (Rasinski & Samuels 2011). With fluency, readers have more attention to devote to the comprehension of the text. Thus, automatic and accurate decoding is necessary for successful comprehension.

There are a number of reading theories which explain word recognition. The theories relevant for this dissertation are discussed in §2.5. For now, however, attention is drawn to the fact that written language represents spoken language, but sometimes not perfectly. The next section addresses orthographic depth and its effect on reading acquisition.

2.3 Orthographic consistency, spoken language structure and its influence on decoding

As mentioned earlier, writing systems systematically represent the sounds of language in written form. Thus, the ease with which decoding occurs is affected by the complexity of the spoken language, and the consistency with which sounds are represented orthographically.

An orthography is the accepted conventional rules of how to write a language within a particular writing system (Aro 2004). The writing systems of the world can be broadly categorised into three types (alphabetic, syllabic and logographic) based on what the graphemes (the smallest units of writing) represent. An alphabetic writing system is one where graphemes or letters represent phonemes, either consistently or not (Bolger *et al*. 2005). Orthographies based on an alphabetic writing system include English, isiXhosa and other Bantu languages in South Africa, Afrikaans, Greek, Russian and Finnish, to name a few. Note that alphabetic orthographies are not necessarily written in Roman letters, e.g. Russian is written in Cyrillic. The graphemes of syllabic writing systems represent the syllables of the spoken language. These writing systems include Japanese Kana and Korean Hangul (Bolger *et al*. 2005). Finally, in logographic writing systems, graphemes represent morphemes (which are syllables) such as the writing of Chinese (Bolger *et al*. 2005). The remainder of the discussion will address orthographic consistency in alphabetic writing systems.

Alphabetic writing systems are based on the alphabetic principle (Liberman *et al*. 1989). The alphabetic principle is the understanding that the limited set of letters in the alphabet represents the limited set of phonemes in the spoken language (Liberman *et al*. 1989). Note here that phonemes (abstract idea of the sound), and not phones (physical realisation of sounds) are represented by letters. For example, in English, /p/ is represented by *p* in writing, as in words like *pat* and *spat*, although these are allophones of /p/ pronounced [p^h] and [p] respectively. Similarly, spelling in Russian represents the underlying phonemes rather than their realisation. Final consonants are devoiced in Russian, but words ending in voiced consonants are still spelled with the voiced counterpart because letters represent phonemes, rather than phones, e.g. *luk* (onion) and *lug* (meadow) are both pronounced [luk] (Rakhlin *et al*. 2014). We can see then that acquisition of this alphabetic principle may not always come easily.

Before anyone can make full use of the symbolic nature of the writing system, they must reach an understanding that written graphemes (letters) correspond predictably (depending on the language) and systematically to phonemes in their language (Chard *et al*. 2000). Once the alphabetic principle is grasped, the systematicity of letter-sound (grapheme-phoneme) correspondences used in reading and sound-letter (phoneme-grapheme) correspondences used in spelling can be exploited for decoding and writing.

To summarise the discussion so far: decoding involves the mapping of written symbols to sounds in the language, and therefore relies on (1) the beginner reader being able to parse sounds in his/her language, (2) the knowledge of how the sounds are conventionally represented in print, and (3) an understanding of the alphabetic principle. This means that children must make use of their awareness of the sounds in their language (phonological awareness), and how their language is written (orthographic awareness) to establish these (un)predictable mappings. Because the phonology of languages and the way they are written down is not identical, decoding (and reading, by extension) is affected by the complexity of the spoken and written language (Goswami 2009).

Point 1, parsing sounds in the language, is further explained in section 2.6. The conventional representation of phonemes in orthographies varies in its systematicity. This is called orthographic depth or consistency. Consistent or transparent orthographies are those which systematically represent the same phonemes with the same graphemes. This means that the pronunciation of words can correctly be made by sounding out the letters. The most consistent orthographies, such as that for Finnish, represent the same sound with the same grapheme (Leinonen *et al*. 2001). IsiXhosa is also written transparently (Doke 1954). This means that the letter *a* always represents the phoneme /a/ such as in *ikati* /ikati/ (cat), *vala* /vala/ (close) and *amanzi* /amanzi/ (water) to name a few. (§2.4 however argues that isiXhosa is not as transparent as authors have stated). The effect of orthographic consistency is that (1) it is easier to learn the mappings between letters and sounds, (2) this reinforces the ability of speakers to parse sounds in their language (Share 1995) and (3) reading is acquired faster (Seymour *et al*. 2003).

On the other hand, inconsistent or opaque orthographies vary in the systematicity of grapheme-phoneme mapping where the same letter does not always represent the same sound, or the same sound is not always represented by the same letter (Bolger *et al*. 2005). The most inconsistent alphabetic orthography is that for English (Share 2008). For example, in English, letter to sound mapping (which affects reading) is quite inconsistent. Consider the letter *a*, it represents a number of different sounds in South African English: *c**a**t* /æ/, *c**a**pe* /eɪ/, *c**a**ll* /ɔː/, *y**a**cht* /ɔ/, *c**a**rt* /ɑː/, and c**a**tastrophe /ə/. English is also inconsistent in the sound to letter mappings (which is used in spelling): /iː/ is represented orthographically as *e* (*me*), *ee* (*see*), *ea* (*sea*), and *eigh* (Leigh). These inconsistencies in opaque orthographies result in needing to learn (1) many more letter-to-sound mappings (for reading), (2) more sound-to-letter mappings (for spelling), which has consequences for the development of phonological awareness, and (3) makes learning to read take longer than in consistent orthographies (Seymour *et al*. 2003).

Furthermore, not only do languages differ in the consistency with which they are written down, they vary in their linguistic complexity. One of the first comprehensive studies to examine the effect of spoken and written language complexity on reading acquisition was that by Seymour, Aro and Erskine (2003). Seymour *et al*. (2003) examined 13 European languages and classified them according to their syllabic structure and orthographic depth to determine whether these two factors affected the speed with which literacy was acquired. Literacy acquisition was operationalised as the ability to name letters, read familiar words and decode nonwords. These tests were made to be as cross-language compatible as possible. In their study of almost 600 Grade 1 children, Seymour *et al.* (2003) found that there was indeed a difference in the rate of acquisition of reading among the 13 languages.

The syllabic structure of the language refers to the legal syllable types. Languages which have primarily open CV syllables with no consonant clusters have simple syllabic structures, and those languages with a number of closed syllables, with consonant clusters have a complex syllable structure. The syllable complexity and orthographic depth complexity categorisation used in their study are reproduced in Table 1 (Seymour *et al*. 2003: 146) for ease of reference. Romance languages are classified as simple syllable structure languages and range in their orthographic depth. On the other hand, Germanic languages have a more complex syllable structure, but also range in the orthographic depth of their writing systems. The languages on the two extremes (Finnish and English) can also be compared to each other.

Table 1. Classification of the 13 European languages by complexity of syllable structure and orthographic depth (Seymour *et al*. 2003: 146)

		Orthographic Depth				
		Shallow				Deep
Syllable Structure	Simple	Finnish	Greek Italian Spanish	Portuguese	French	
	Complex		German Norwegian Icelandic	Dutch Swedish	Danish	English

Seymour *et al*. (2003) found that syllable complexity and orthographic depth influenced reading acquisition differently. Syllable complexity only affected nonword reading, with simple syllable structure language readers outperforming those who read languages with complex syllable structures. Thus, languages with simple phonology (open CV syllables, few consonant clusters) make the acquisition of basic decoding skills easier than languages with complex phonology (many closed syllables, many consonant clusters). The authors explain that this is due to the lack of consonant clusters making it easier for readers of a syllabically simple language to cement their knowledge of grapheme-phoneme correspondences necessary for decoding since phonemes often occur in isolation: *s* is easier to match to /s/ because it never occurs in a cluster. However, in syllabically complex languages, the increased number of consonant clusters makes it difficult to learn the phonemes in isolation because of different realisations in the language, e.g. /t/ occurs in clusters as /tɹ/ (*trip*), /st/ (*stay*), /lt/ (*built*), and /ts/ (*cats*).

Seymour *et al*. (2003) also found that orthographic depth influenced performance on real word reading accuracy and speed with the consistent orthography readers (e.g. Finnish) achieving higher rates of accuracy and faster times than readers of inconsistent orthographies (e.g. Danish and English). Similarly, readers of consistent orthographies outperformed those of inconsistent orthographies in the nonword reading task. There are fewer grapheme-phoneme mappings necessary to read in a consistent orthography, so reading is acquired earlier.

Furthermore, there is an interaction between syllable complexity and orthographic depth. Examination of the lexicality effect (the advantage of real words over nonwords) showed that there is a greater performance on real words in the complex syllable and deeper orthography languages. Readers of languages with simple syllable structure and consistent orthographies show a smaller increase in performance on real word than nonword tasks. This indicates that at some level, these readers are reading words and nonwords with similar grapheme-phoneme decoding strategies, but readers of inconsistent orthographies, with complex syllables structures, read real words differently to nonwords, perhaps relying on whole word recognition or larger grain sizes, in the case of real words. However, the groups did not differ on letter recognition accuracy or speed indicating that the difference in rate of acquisition of reading is not due to not being able to identify letters.

This study by Seymour *et al*. (2003) was one of the first studies to comprehensively highlight the interactive effects between syllable complexity and orthographic depth. The syllable complexity, other linguistic aspects and orthographic depth of isiXhosa are described below. Following this, reading theories of relevance to this dissertation are described. Since there is no comprehensive study describing reading acquisition in isiXhosa, it is necessary to examine the language structure and orthographic depth of isiXhosa and how this compares to other languages for which there is available research.

2.4 IsiXhosa: linguistic and orthographic complexity

This section addresses the linguistic structure of isiXhosa as well as the way it is represented orthographically. The alignment or misalignment of the orthography and the spoken language structure is discussed with how it may affect literacy acquisition.

Many researchers on isiXhosa remark on the language's transparent orthography (Doke 1954, Pretorius 2010, Land 2015), but so far none of these accounts have given a satisfactory explanation of just how transparent isiXhosa is. Saul (2013) argues against the assumption that isiXhosa is completely transparent, but does not relate this conclusion to literacy acquisition. For this reason, the following section details my categorisation of the orthographic depth of isiXhosa, and my interpretation of how this may affect literacy acquisition. I rely on the description of isiXhosa orthography in The Greater Dictionary of Xhosa (University of Fort Hare 1989), and the suggestions made by Saul (2013). It is important to understand how the specific language structure of isiXhosa and orthography interact because its categorisation as consistent or inconsistent could affect the interpretation of the findings later in this study.

2.4.1 IsiXhosa alphabet

IsiXhosa writing makes use of the 26 letter Roman alphabet (University of Fort Hare 1989, Louw 2005). However, as is discussed in §2.4.3, there are many consonant phonemes in isiXhosa that must be represented by this limited set of letters. For this reason, there are many combinations of letters in letter groups to represent the large sound inventory. The orthographic representation of vowels and consonants is addressed in §§2.4.2 and 2.4.3 respectively.

2.4.2 Vowels

IsiXhosa has 5 vowel phonemes /a e i o u/. The mid vowels have the allophones [ɛ] and [ɔ] *(*Doke 1954, van der Merwe & le Roux 2014). The vowels are represented orthographically by 5 letters as a*, e, i, o,* and *u*. Some of the vowels can be doubled to indicate vowel length due to morphological and phonological changes, e.g. ***oo****mama* (mothers), *ng****ee****nyawo* (with the feet), and ***ii****ntombi* (girls).

The letter-sound mappings for vowels should theoretically be easy to acquire in isiXhosa. This is because there is a small set of vowels in the language which are represented quite transparently in print. The only place where irregularity occurs is that the allophones of /e/ and /o/ are not uniquely represented in print. This may not be problematic considering that alphabets represent the phonemes, rather than the phones, of a language, and that the allophone pronunciation can be recovered from context.

2.4.3 Consonants

IsiXhosa has a large number of consonant phonemes (Doke 1954). IsiXhosa has both plain and click consonants resulting in about 77 consonant phonemes (Doke 1954, Saul 2013). The complication arises in the orthography where this large inventory of consonants must be represented uniquely by the 21 remaining Roman letters of the alphabet. This results in some sounds being represented by orthographically complex letter groups but the orthography-phonology correspondences are very transparent with some exceptions. The orthography-phonology correspondences for isiXhosa are presented in Appendix A.

In writing, the uninformed may mistake the letter groups as consonant clusters. Letter groups consist of multiple letters which represent a single phoneme. I also refer to letter groups as complex graphemes e.g. in English *sh* represents one sound /ʃ/ in ***sh**ip* /ʃəp/, *hl* in isiXhosa and isiZulu represents one sound /ɬ/ in *ame**hl**o* /ameɬo/ (eyes). The complex graphemes, in this case digraphs, represent one sound, with two letters. Trigraphs consist of three letters and quadgraphs consist of four letters. On the other hand, a consonant cluster is group of consonants which are pronounced consecutively in the speech stream e.g. ***sl**ip* in South African English is /sləp/ and *um**ntw**ana* in isiXhosa is /um.^{n}twa.na/ where /s/ and /l/ and /^{n}t/ and /w/ form clusters. Clusters in isiXhosa, and those that have arisen from word borrowing, are addressed in §2.4.4.

The implication of the many letter groups is that some words can be many letters long, which takes longer to read in the early stages of reading. Research shows that word length (by definition number of letters in the word) affects word recognition for beginner and dyslexic readers because they approach words with a letter by letter decoding strategy (Ziegler *et al*. 2003, Zoccolotti *et al*. 2005, Marinus & de Jong 2010). That is to say, dyslexic and beginner readers take more time to read words which have many letters. In addition, when some of the letters in the word are digraphs, it takes longer to decode these words as compared to other words of similar phoneme length (e.g. *ship* takes longer to read than *sip)* for beginner and dyslexic readers especially in reading nonwords (Marinus & de Jong 2010). Thus, in isiXhosa, the high frequency of complex orthography may affect reading acquisition, where decoding may take longer, but for more skilled readers, the occurrence of complex orthography should not affect decoding because of automaticity in orthography-phonology correspondence, no matter how many letters are in the cluster.

Appendix A shows that isiXhosa makes use of many letter groups to uniquely represent the sounds in the language. However, for the most part, sounds are represented very consistently with the implication that it should be relatively easy to establish orthography-phonology correspondences for the beginner reader, as it is in Finnish for example. Finnish is one of the most transparently written alphabetic languages and children reading Finnish achieve high levels of accuracy after only a few months of literacy instruction (Seymour *et al*. 2003). In contrast to isiXhosa, Finnish has 21 phonemes in total with 24 sound-letter correspondences which are completely transparent (Leinonen *et al*. 2001, Frost 2012). English has about 40 phonemes but is written with an opaque orthography and therefore readers take longer to become accurate (Sweet 2004). Some argue that readers of a more transparent orthography become accurate faster because they can read by focusing only at the phoneme level (because letters consistently represent single phonemes), and there are fewer orthography-phonology correspondences to learn (Miller *et al*. 2012). However, there are many more orthography-phonology correspondences to learn in isiXhosa, compared to Finnish, but which are transparent (in contrast to English which has many correspondences but is opaquely written). This level of complexity introduced by the number of (albeit consistent) orthography-phonology correspondences and its potential effect on literacy acquisition is not explicitly addressed by other authors who classify isiXhosa as transparent (e.g. Doke 1954, Pretorius 2010, Land 2015). More research is needed on the influence of the large number of orthography-phonology correspondences on reading acquisition and skilled reading.

Furthermore, not only are there many graphemes to learn in isiXhosa, but there are some cases of inconsistency, where one grapheme represents a number of phonemes. For example, *h* represents both the voiceless glottal fricative in /uhili/ (river-sprite) and the glottal fricative with breathy voice in /iɦolo/ (hall) (University of Fort Hare 1989: xlviii). Irregularity also occurs in letter clusters for example in the trigraph *tsh* which represents both the voiceless ejective alveolar affricate /tʃʾ/ in *ukutshica* (spit) and the voiceless aspirate alveolar affricate /tʃʰ/ in *ukutsha* (burn) (University of Fort Hare 1989: li). The irregularity in this cluster occurs when the sounds are followed by /w/ in a consonant cluster such as in *tshw*. In some cases irregularity arises through loan words. For example, *kr* represents the voiceless ejective velar affricate /kx/ (*-krakra* (bitter)) as well as a consonant cluster occurring in loan words /k'r/ such as *ikriva* (wheelbarrow); gr represents the velar fricative with breathy voice /ɣ/ in ukugrenya (gnaw) and a consonant cluster /gr/ from borrowing in *igrabile* (gravel) (University of Fort Hare 1989: xlviii). The majority of letters and letter groups are completely regular with a few exceptions. The introduction of new words from English and Afrikaans has also lead to the introduction of consonant clusters, which increases the irregularity of some correspondences.

The analysis of grapheme-phoneme correspondences indicates that isiXhosa is not completely transparent, having some exceptions e.g. *tsh* as /tʃʰ/ or /tʃ'/). Although the literature on orthographic consistency addresses the consistency of orthography-phonology correspondences and how this affects speed of literacy acquisition, the literature is silent on the influence of the number of orthography-phonology correspondences that must be learned. That is to say that research has not yet explored to what extent the number of mappings to be learned (rather than, or in addition to, the consistency of mappings) affects reading acquisition. It may be the case that the sheer number of mappings to be learned (irrespective of how consistent they are) may slow down reading acquisition. Further research is warranted in this area.

The next section addresses the occurrence of consonants and vowels in syllables, by examining the syllable structure of isiXhosa, and how this may affect literacy acquisition.

2.4.4 Syllables

IsiXhosa has a mostly simple syllable structure, similar to that for Italian or Spanish. IsiXhosa syllables are generally open with a consonant-vowel (CV) structure, some syllables only contain a vowel, and there are few closed syllables, usually only permitting /m/ in the coda (Doke 1954, van der Merwe & le Roux 2014). For example, *vula* (open) /vu.la/ has a CVCV structure, *ikati* (cat) /i.ka.ti/ has a VCVCV structure where the first syllable only contains a vowel, and finally some syllables end on a nasal: *namhlanje* (today) /nam.ɬa.ndʒe/. Since most syllables have a CV type with only /m/ permitted in the coda, the syllable structure is simple. In addition, there are historically few consonant clusters, where consonants are pronounced consecutively with no intervening vowel. The only 'true' consonant clusters occur with a consonant followed by the semi-vowel /w/ (Saul 2013). There are 8 such instances of clustering with /w/: *ukupa**thwa***, *kwaqa**ndwa***, *i**ntw**azana*, *yo**dwa***, *uku**ntyw**ila*, ***kw**ale*, and *ama**khw**e**nkw**e*. Thus, the syllable structure can be classified as more simple than complex, with mostly open syllables, only /m/ permitted in the coda and only 8 clusters (occurring with /w/). This simple syllable structure should enable faster literacy acquisition, according to the study by Seymour *et al*. (2003).

However, with language contact, clusters and codas have been introduced into isiXhosa (Saul 2013). For example, ***ikl**oko* /ikloko/ (*clock*) contains a cluster /kl/. Saul (2013: 167) identifies the clusters introduced from contact with English and Afrikaans which are usually with liquids: *pl, pr, bhr, tr,dr, kl, kr, gr, gl, fr, fl.* At the same time, existing graphemes have been used to write loan words that contain a cluster. For example, *i**gr**ama* /igrama/ (grammar) uses the digraph *gr* which traditionally represents the voiced velar fricative in isiXhosa, but in *igrama*, *gr* represents the cluster /gr/. These loan words may become problematic, firstly for introducing clusters which the syllable structure of isiXhosa does not historically contain, as well as using the existing graphemes to represent new sounds, decreasing the orthographic consistency. Loan words have also introduced syllables which contain non-/m/ codas. For example, *iteksi* (taxi) can be syllabified as /i.tek.si/. Although not increasing the orthographic complexity of isiXhosa, this may affect other cognitive skills which are affected by syllable structure, such as phonological awareness. Language contact clearly has played a role in affecting isiXhosa orthography and allowable syllables. However, the frequency of loan words in children's reading and instructional materials is not known, as well as the impact it would have on literacy acquisition. Further research is needed to quantify this effect but it is out of the scope of this thesis.

2.4.5 Tone

Furthermore, tone is used contrastively in isiXhosa. Tone is not represented orthographically in isiXhosa but must be inferred from the context (Saul 2013). For example the orthographic word *ithanga* is pronounced with the following tones to contrast meaning:

(1a) *íthàngá* – thigh

(1b) *íthàngà* – pumpkin

(1c) *íthângà* – cattle outpost

Examples are taken from the Greater Dictionary of isiXhosa (University of Fort Hare 1989: 272-273).

Land (2015) discovered that ambiguous meanings resulting from tone not being represented in print, affected reading speed negatively. Therefore, because tone is not represented orthographically, the lack of marking it introduces some orthographic complexity (for pronunciation and meaning (Saul 2013)) not addressed in studies of European languages (van der Merwe & le Roux 2014). Although out of the scope of this thesis, further research should be conducted on the role of tone for phonological awareness and reading acquisition. If phonological awareness is the awareness of phonemes in the language, then there is a need to address the awareness of tone and how this affects reading acquisition (Zhang & McBride-Chang 2010).

2.4.6 Morphology

Not yet addressed is the morphological complexity of isiXhosa. IsiXhosa is an agglutinating language where morphemes (meaning units) are added to root morphemes (Doke 1954). Other agglutinating languages include Finnish, Turkish and Bantu languages found in South Africa such as Sesotho or isiZulu, to name a few. Because of the agglutination in the morphology, and vowel changes which result, the writing system is conjoined. This means that morphemes are written together without visual spaces in between. This can be seen in example (2) below.

(2) Ndiyathetha → ndi-ya-theth-a
SM1SG-DIS-speak-FV

In practice, however, the rules of conjoining units is not always followed (Saul 2013) and so the conjoining of units may lead to inconsistency in writing e.g. *baza kufika* (*they will arrive*) as two words vs *bazakufika* as one word. Misapplication of the rules for conjoining may make reading isiXhosa less consistent because the boundaries between morphemes are less clear. Nevertheless, it can be assumed that materials developed for children learning to read do systematically check the orthographic representation of sentences for consistency.

IsiXhosa uses a system of 15 noun classes, as well as complex verbal, adjectival and adverbial morphology which is written conjoined. IsiXhosa orthographic words may be quite long, and therefore contain more letters. Land (2015) examined the skilled reading of isiZulu speakers in an eye-movement study. Participants were required to read a number of texts, which on average had 7.73 letters per orthographic word. She compared this number to a study that examined the average letters per word in Finnish newspaper writing. Finnish is also agglutinating and had on average 7 letters per orthographic word (Björnsson, 1983 cited in Land 2015). In comparison, in the same study on newspaper writing, English words were on average 4.6 letters long. We can see from acquisition data that increased word length (or number of letters) is not problematic in the context of a consistent orthography (such as Finnish) where reading accuracy is attained early in acquisition (Seymour *et al*. 2003).

There is evidence from isiXhosa that the morphology influences the awareness of syllables and phonemes at the end of words (Diemer *et al*. 2015). This is because morphological changes can affect the end of a root morpheme, but rarely the beginning of the root morpheme. Language specific effects on the cognitive skills underlying reading are addressed in §2.6.3

2.4.7 Literacy implications for isiXhosa

In summary, what at first seemed to be a simple categorisation of isiXhosa as a simple syllable language which is orthographically consistent, has become more complicated and not as clear cut.

IsiXhosa has a large number of consonant phonemes which is mirrored in the number of grapheme-phoneme mappings that the beginner reader must learn. Analysis of what graphemes represent which sounds showed that there are a large number of orthography-phonology correspondences to be learned (over 70) at the letter/letter group – phoneme level but these correspondences are all mostly consistent. The implication for reading acquisition is that once the many grapheme-phoneme mappings are learned, reading speed and accuracy should increase steeply, and literacy should be acquired quite early, at least within the first year of reading instruction. This is because the same sounds are consistently represented in print by the same letters. This in turn should have a positive effect on phonological awareness (discussed further in §2.6). What is not yet known is the exact impact that the large number of (albeit consistent) mappings would have on speed of reading acquisition.

The syllable structure of isiXhosa, being mostly open with few consonant clusters, should enhance the beginner reader's ability to read with accuracy and speed (Seymour *et al.* 2003). However, it was noted that the frequent use of words borrowed from English and Afrikaans, have introduced consonant clusters, and in some cases, codas. The influence of borrowed words on reading acquisition has not been previously addressed in the literature and is out of the scope of this thesis. However, one could assume that the introduction of borrowed words with different phonological structure to 'real' isiXhosa, introduces a level of orthographic complexity, and may affect reading predictors like phonological awareness. The role of teaching instruction should also not be ignored.

Finally, the conjoined writing system, suited to agglutination, may introduce some orthographic complexity when writers are not consistent in the placement of visual spaces in orthographic words. However this effect should be limited in the carefully constructed texts for beginner readers. Because of its relative transparency, it may be the case that isiXhosa readers only rely on a grapheme-phoneme reading strategy.

In conclusion, this section aimed to determine the exact transparency of written isiXhosa, taking into account how orthography is affected by linguistic structure. This section highlighted that isiXhosa does not have a completely transparent 1:1 relationship between letters and sounds, because of the large number of sounds that need to be represented by the limited Roman alphabet letters, and the introduction of clusters and codas from borrowed words. Furthermore, because of its morphology there is sometimes confusion as to how orthographic words should be recorded with and without spaces. With this in mind, I conclude that isiXhosa is still a simple syllable language and therefore reading acquisition should be similar to that for the languages in the first row of Table 2, i.e. speed and accuracy should be acquired earlier in reading than those of a complex syllable language. Furthermore, isiXhosa is relatively transparent, although not as transparent as Finnish. I would categorise isiXhosa along with Greek, Italian and Spanish based on the evidence described in this section. Thus, isiXhosa readers should pattern similarly: reading accuracy should reach ceiling levels earlier on in reading instruction and speed in reading should also be achieved earlier.

Table 2. IsiXhosa as compared to other orthographies according to the Seymour *et al*. (2003: 146) conceptualization of syllable and orthographic complexity

		Orthographic Depth				
		Shallow				Deep
Syllable Structure	Simple	Finnish	Greek Italian Spanish **isiXhosa**	Portuguese	French	
	Complex		German Norwegian Icelandic	Dutch Swedish	Danish	English

2.5 Reading theories and hypotheses

This chapter has so far addressed decoding in reading as the process of using orthography-phonology correspondences to reach the word's pronunciation and meaning. Comprehension was also described as resulting from automatic and fluent decoding (§2.2). The notion of a continuum of orthographic consistency was broached in §2.3 where it was established that languages written down in less consistent ways take longer to learn to read. §2.4 then established that isiXhosa is mostly transparent with the implication that reading should be somewhat unproblematic to acquire because of the consistency with which it is written, given that teaching methods are appropriate, although the large number of correspondences to learn may affect the speed of acquisition negatively.

The emphasis so far has been on how decoding reaches higher levels of accuracy and speed earlier in transparent orthographies than opaque ones. Mention was made about why this is the case: that the consistency enables beginner readers to establish the sound letter mappings in their language faster (because they are consistent), and through further reading, these mappings are cemented, thereby increasing reading abilities further. Not yet addressed is what process(es) underlie(s) the foundational skill of decoding necessary for word recognition, and whether these processes are universal, or affected by orthographic consistency. It is important to have an understanding of current reading theories in order to determine their stance on the involvement of cognitive skills, which would influence the interpretation of the data presented in this thesis.

No matter the theoretical framework, it can be agreed that reading is a complex process that relies on the integration of a number of sub-processes. It is not surprising, therefore, that a number of skills are inherently involved in the reading process. Looking specifically at word reading, the processing of phonology (Wagner & Torgesen 1987), morphology (Carlisle 2003), syntax (Chard *et al*. 2000), semantics (Bolger *et al*. 2005) and orthography (Aro 2004) are important contributors (Kirby *et al*. 2010). However, the current and most accepted view in reading today is that the core underlying process or skill necessary for decoding in an alphabetic orthography is phonological processing (Stanovich 2000, Melby-Lervag *et al*. 2012). The processing of phonological information to understand oral and written language includes three constructs (Wagner & Torgesen 1987, Wagner *et al*. 1993). These are phonological working memory, phonological awareness (addressed in §2.6) and the retrieval of phonological representations from long-term memory (addressed in §2.7.3.1). Phonological working memory refers to the conversion of orthographic representations into phonological representations, in working memory, so that the lexical item can be searched for (Wagner & Torgesen 1987).

An understanding of how reading happens in different languages, or universally is still not agreed upon because of the “fractious nature” of the reading field (Stanovich 2000: 407). A number of researchers from a number of fields (including but not limited to psychology, neuroscience, linguistics, speech pathology and education) studying different languages all contribute to what we know about reading and so scholarly debate about the reading process abounds (Stanovich 2000, Pretorius 2010). Although the majority of research documents the reading process in English, there is a growing body of research that addresses reading in other languages. Although English is unarguably the most researched language when it comes to the reading process; there is still debate about how the sub-processes of reading are related in the normal reader. This discussion becomes even more complicated when examining the cross-linguistic literature since English is an ‘outlier’ orthography, calling into question reading theories based on reading in this language (Share 2008). A number of languages are still not represented in the discussion of reading processes. With reference to cross-linguistic research, South Africa’s contribution to the enquiry of reading shows some involvement, mostly in the macro-approaches to literacy, but not much in terms of the micro-linguistic approaches (de Vos *et al*. 2014). My thesis contributes to the micro-linguistic understanding of literacy in isiXhosa, which can be transferred to other Nguni languages.

A number of reading theories have been proposed and refined based on reading evidence (mostly from English). The reading theories and hypotheses relevant to my study are addressed in this section. One of the earlier theories, the Orthographic Depth Hypothesis (§2.5.1), proposes two routes to reading one route which relies on phonological processing and one route which relies on visual-orthographic processing, but research in more consistent orthographies showed that the use of a visual-orthographic route in decoding may be unnecessary. The Psycholinguistic Grain Size Theory (§2.5.2), on the other hand proposes only one phonological route to reading, emphasising the readers’ phonological awareness. This theory convincingly explains reading acquisition and skilled reading in a number of languages, but has not yet been applied to explain reading in isiXhosa. The Double Deficit Hypothesis (§2.5.3) proposes, in addition to the phonological route, an added influence of naming speed, a second variable in explaining the reading of dyslexic readers. The role of naming speed in isiXhosa reading and the Psycholinguistic Grain Size Theory is yet to be explored. These three reading theories, and their explanation of the roles of phonological awareness and naming speed in reading, are addressed below.

2.5.1 The Orthographic Depth Hypothesis

The Orthographic Depth Hypothesis (ODH) offers an explanation for the differences observed when reading in shallow and deep orthographies, hypothesising that there are two different mutually exclusive processes for word recognition (strong version), or that there are two processes with their balance differing according to the orthographic depth (weak version). The basic tenets of this hypothesis are expanded on below.

The ODH proposes that the processes underlying reading are not universal (or the same for all orthographies); rather, the processes underlying reading differ according to orthographic depth (Katz & Frost 1992). The two process underlying reading include word recognition through phonological recoding, and word recognition through visual-orthographic processing which mostly relies on morphemes being represented in print. There is a strong and weak version of this hypothesis, but both versions maintain that phonological recoding is used in word recognition, although to different extents depending on orthographic depth.

In the strong version of this hypothesis, the reading of shallow orthographies only ever requires use of the phonological recoding route. Katz and Frost (1992) themselves acknowledge that this version is mostly untenable considering that even in shallow orthographies high frequency words are read faster than low frequency words, indicating that the visual-orthographic route is at play. The weak version of the ODH proposes that, even in a shallow orthography, the visual-orthographic route is used for word recognition. The weak version further states that the relative weight of either processing type depends on orthographic depth. Thus, in a shallow orthography, the reader theoretically mostly relies on phonological recoding, but in a deeper orthography, there is more incentive to rely on the visual-orthographic route to process the morphology, rather than phonology.

The ODH offers an insightful explanation for the evidence that indicates different processes underlying reading in different orthographies and languages, but still emphasises that phonological processing is important in all orthographies. However, as the theory is proposed here it does not address "the question of just how *prevalent* the use of phonology is, *relative* to the use of visual-orthographic coding, for any given orthography" (Katz & Frost 1992: 158, emphasis added). This theory does not explain what units of phonology are used in recoding (although it can be assumed that phonology is accessed at the level of the phoneme), or how readers develop their visual-orthographic processing. The ODH also cannot be used to explain why readers of a shallow orthography acquire literacy so much faster than those of a deep orthography (Seymour *et al*. 2003) since Katz and Frost (1992) do not suggest that the establishment of visual-orthographic processing takes longer. Finally, this theory purports that two separate processes for reading are needed in orthographies differing in consistency, however, there is a need to look for a theory to explain reading in all languages.

2.5.2 The Psycholinguistic Grain Size Theory

The Psycholinguistic Grain Size Theory (PGST), proposed by Ziegler and Goswami (2005, 2006), developed out of a need to explain the growing body of cross-linguistic research in languages which use orthographies of varying consistency. This theory offers an explanation of reading development, skilled reading and reading dysfunction. For Ziegler and Goswami (2005), understanding skilled reading rests on an understanding of the acquisition of reading; and understanding dysfunctional reading rest on an understanding of the former and the latter. This section addresses and evaluates the key principles of this theory.

PGST emphasises the importance of phonological processing for reading, proposing only one phonological route. PGST describes exactly how phonological recoding (orthography-phonology translation) takes place, arguing that readers develop grains (phonology-orthography correspondences) of different sizes for reading words and nonwords, depending on the consistency of orthography-phonology correspondences at different levels. The choice of different phonological recoding strategies is affected by reading age, orthographic consistency, word frequency, and whether the task is timed or not (Ziegler & Goswami 2005). Thus, unlike the ODH the issue in PGST is not that there are two routes for reading, or whether phonological processing or orthographic processing dominates in a particular orthography, but how the reader uses different grain sizes flexibly according to the demands of the task or their reading age (Goswami *et al*. 2003).

PGST explains that readers must solve the three problems of phonological availability, orthographic granularity and the consistency between these two in order to learn to read and become skilled readers. A schematic diagram of this is presented in Figure 1, below. Writing is the orthographic representation of spoken language necessitating the use of phonology-orthography correspondences in reading. However, difficulty arises in that the phonological units made available in one's language (phonological availability), does not necessarily match the units made available in the orthography (granularity). In phonological development it is the case that readers become sensitive to larger units before smaller units, consequently, larger phonological units are more available to the beginner reader. On the other hand, readers need to learn the orthographic representation of these sounds in their language. Alphabetic orthographies emphasise the letter (or letter groups) as a unit which represents the phoneme. Thus, the most common unit used to represent sounds in an alphabetic orthography is the letter (granularity). However, orthography can also represent onsets and rimes, syllables, or whole words more consistently than letters. Finally, orthographies differ in the consistency which phonology is represented orthographically, which also affects reading.

The task of the beginner reader is to solve the three problems of availability, granularity and consistency. That is to say, readers must overcome the fact that they are more sensitive or have better awareness of larger phonological units such as the rime or syllable, and that the orthography represents the smallest units of sound, the phoneme, as letters. Furthermore, the relationship between phonemes and letters may not always be consistent, but the relationship between larger phonological units such as the rime, may be more consistently represented orthographically. For this reason, readers learn to make use of different grain sizes for phonological recoding. Through reading, and reading instruction, readers learn that certain orthographic units correspond more consistently to certain phonological units, and they learn to read through mapping orthography to phonology at different (grain) sizes such as the phoneme, syllable, rime or word, depending on what is most consistent in that orthography.

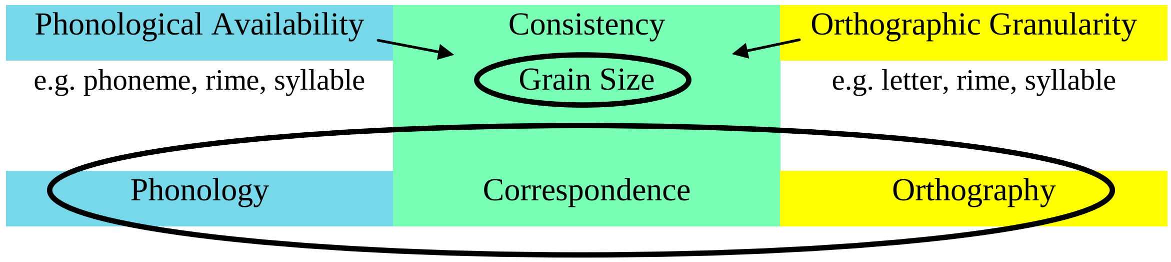


Figure 1. Schematic representation of the Psycholinguistic Grain Size Theory

A grain size is a unit of sound (phoneme, rime, body, or syllable) that is mapped to a unit of the orthography (letter, syllable, rime). A grain is therefore an orthography-phonology correspondence (Goswami *et al*. 2003). A small grain size is a grapheme (single letter or letter group) mapped to a single phoneme e.g. making use of the smallest grain size, at the phoneme level is reading *ship* as [ʃ] [ə] [p] (Mahon 2010). At an intermediate level, a larger grain size would be groups of letters matched to a larger sound unit such as the rime or syllable e.g. reading *ship* as [ʃ] [əp] based on the analogy to ***pip***, ***rip***, ***sip***, ***lip*** where ***-ip*** always corresponds to the rime [əp]. Here the rime is used as a grain size. Grains also occur at the size of the syllable. The whole word can also be a grain size. In PGST, the whole word acts as a grain and therefore, is still part of the single phonological route to reading, rather than a visual route. The use of a morpheme as a grain has not yet been established and further research is warranted in this area (Durgunoglu 2006).

According to PGST, the reader relies on different grain sizes depending on the consistency of sound-orthography units in the writing system and the frequency of the sounds in the language (known as neighbourhood characteristics) (Ziegler & Goswami 2005). Readers of a consistent orthography, where the same letters consistently represent the same phonemes, are more likely to make use of a small grain size. For example, readers of a consistent orthography such as Italian predominantly can focus their decoding using the smallest grain size (phoneme-letter(s)) because phonemes are consistently represented by letters. However, in languages where there is greater inconsistency at the phoneme-letter level, grain size units at the rime level may be more consistent, and therefore may be more efficient for decoding in that language. For example, English is more consistent at the rime than the phoneme level, leading to readers of English also using a larger grain size such as the rime. This then helps English readers read words like *s**ight***, *b**ight***, *r**ight*** by recognising common rime-orthography mappings. However there may still be inconsistency at this level: for example **ite** also maps to /ai/ in ***site,*** *b**ite,*** and *r**ite***. Note that grain sizes are not mutually exclusive. Readers may use grains of different sizes depending on the context and reading development. There is evidence to show that readers of a consistent script, such as Italian, do develop recoding at larger grain sizes as they become more skilled (Paulesu 2006).

Readers of inconsistent orthographies take longer to learn to read because they have to develop efficient phonological recoding at multiple grain sizes and therefore pay attention to different orthographic unit sizes (Land 2011). A consequence of this inconsistency is that they also have many more orthography-phonology correspondences to learn (Miller at al. 2012). On the other hand, readers of a consistent orthography can rely on using only the smallest grain size, and therefore have fewer correspondences to learn than readers of an opaque orthography. Use of small grain sizes relies on using phoneme awareness, which develops faster in consistent orthographies, as discussed earlier, thereby re-enforcing use of the smallest grain size. Finally, the use of different grain sizes can be explicitly taught and is affected by teaching methods (Ziegler & Goswami 2006). Thus for English reading, recoding words by analogy (using rime) can be taught to learners, and for consistent orthographies, the teaching methods can capitalise on using a small grain size.

Since the phonological route is theorised to be very important for reading, according to PGST, there is a need to understand what underlying skills are theorised to be included in this route. Ziegler and Goswami (2005) dedicate an entire section to explaining the development of phonological awareness and repeatedly mention that "children's representation of the phonological structures characterising their language", otherwise known as phonological awareness, is very important for reading (Ziegler & Goswami 2005: 4). Furthermore, dyslexia, a reading disability, is a consequence of an impaired phonological system (Stanovich 2000).

Ziegler and Goswami (2005) however, never specify exactly what they mean by the phonological system.

Earlier in this chapter it was explained that phonological processing includes (1) phonological awareness, (2) verbal working memory, and (3) access to phonological information in long-term memory. These are traditionally measured by (1) phonological awareness tasks (such as elision/deletion), (2) digit span and nonword repetition tasks, and (3) rapid automatized naming tasks, respectively. In their discussion of how PGST confidently explains dyslexia in all languages studied to date, Ziegler and Goswami (2005) remark that dyslexic readers are similar across languages in that they display difficulties in "syllable deletion, syllable reversal, nonword repetition and rapid automatized naming" (Ziegler & Goswami 2005: 20). Thus, it can be assumed that PGST takes the view that all three (phonological awareness, verbal short-term memory and access to phonological representations in long term memory (as measured by rapid automatized naming tasks) constitute phonological processing. Furthermore, PGST accepts that naming speed, as measured by a rapid automatized naming task, is a measure of the speed of lexical access, and is therefore a phonological processing component. Therefore, PGST proposes that all three types of phonological processing components are essential for successful phonological recoding. Unfortunately, the theory does not adequately explain which components are responsible for what aspects of phonological recoding at the different grain sizes. It is only specified that phonological awareness is important for the availability level of the PGS Theory. Ziegler and Goswami (2005) do not theorise what role verbal working memory, or access to lexical representations play in phonological recoding at different grain sizes. This lack of specification of the different phonological components is returned to in the following sections which address phonological awareness and naming speed.

The PGS theory, because of its emphasis on phonological representation available to the beginner reader, points out the need for further research on supra-syllabic aspects of phonology, such as tone or stress (Ziegler & Goswami 2005). Of particular importance to isiXhosa, is tone. There is a lack of available research on phonological awareness and tone, and how this would fit into a PGST approach to explaining reading acquisition and in fact, how tone affects reading acquisition at all[2]. Research is needed in this area to increase understanding of the role of tone for reading in isiXhosa.

[2] Zhang and McBride-Chang (2010) provide a review of the involvement of supra-syllabic elements on phonological and auditory processing, and postulate the Developmental Model of Auditory Processing and Reading. Explaining this model is out of the scope of the thesis, however.

2.5.3 The Double Deficit Hypothesis

The Double Deficit Hypothesis (DDH) seeks to explain developmental dyslexia and is therefore a theory of reading disability (Wolf & Bowers 1999). Caution must therefore be advised for transferring its predictions to normal reading. This theory is included in this dissertation because of the importance it places on a second predictor, naming speed (NS), for reading disability. This thesis examines the role of NS, as well as PA, in isiXhosa within a PGST framework[3].

The DDH proposes that there are two deficits which underlie dyslexia: deficits in phonological awareness, and those in the processes underlying naming speed (Wolf & Bowers 1999). Unlike PGST, the DDH regards NS as measuring something non-phonological i.e. an added construct that explains reading impairment.

Wolf and Bowers (1999) acknowledge that phonological processing is essential for reading acquisition, and that deficits in phonological processing are to blame for reading failure. However, they further postulate that another (non-phonological) factor is responsible for reading failure, and that is the processes underlying naming speed. (As yet, consensus has not been reached about what exactly naming speed measures. This is addressed in the next section.) Wolf and Bowers (1999) claim that there are three sub-types of dyslexia: a phonological awareness deficit sub-type, a naming speed deficit sub-type, and the most severe form of dyslexia is those who have the double deficit sub-type with deficits in both naming speed and phonological awareness.

The different sub-types of dyslexic readers present with different problems in reading (Wolf & Bowers 1999). The phonological awareness deficit group perform below average (as compared to their ‘normal’ peers) on phonological tasks (such as deletion), nonword reading and reading comprehension, without problems in naming speed. The naming speed deficit group performs poorly on timed measures or measures which require speed, such as naming-speed tasks, reading fluency, and reading comprehension, but has no phonological awareness deficit. The reasons both groups perform poorly on comprehension is because of inaccurate reading, and laboured reading respectively. The double deficit group has impairments in both phonological and speed areas, and is therefore the most impaired.

---

[3] Two theories exist which do theorise about the role of NS in reading. These are the Developmental Model of Auditory Processing and Reading (Zhang & McBride-Chang 2010), and the Causal Path Model (Boets *et al.* 2008). This thesis takes a narrower scope by focussing on the role of NS in the PGS Theory, while drawing on the predictions of the DDH only.

From this theory, it can be seen that PA and NS are responsible for different reading outcomes (i.e. they contribute independently to different reading variables), where PA is needed for reading accuracy, and NS is important for the speed of processing which is required to reach fluent reading. Both accuracy and fluency are necessary for comprehension. The different roles of these two skills are explained further in the following section.

The essential role of PA in reading has already been established, but this theory then emphasises the role of NS as another factor that is important for reading, or at least is a good indicator when reading fails, such as in dyslexic readers. A growing body of research has shown that there is evidence to support the DDH (Kirby *et al*. 2010, Norton & Wolf 2012), but remember that Wolf and Bowers (1999) argue that NS is not a component of phonological processing. If NS is as important for reading as the DDH postulates, then there is a need to specify the role of NS in theories of reading acquisition and skilled reading. PGST is one such theory which seeks to explain reading acquisition and skilled reading. Therefore, the role of NS must be expanded on in PGST if NS is shown to contribute to reading ability in 'normally' developing readers. Whether NS measures something (non)phonological must therefore also be established since PGST proposes only one phonological route.

It must be re-emphasised that the DDH provides an explanation of dyslexic reading, so caution must be used when transferring its predictions to 'normal' populations. In fact, Wolf and Bowers (1999) reference other studies of 'normal' readers where naming speed ceases to be a good predictor because in 'normal' populations high levels of automaticity are reached by Grade 2 or 3. On the other hand, NS remains a good predictor for poor readers because they do not reach high levels of automaticity. This finding highlights that perhaps it is not necessary to outline the role of NS for reading acquisition and skilled reading in PGST. However, PGST also claims to offer an explanation of dyslexia, and therefore, needs to address the role of NS, which clearly has a role in predicting (dysfunctional) reading.

2.5.4 Summary

The theories addressed in this thesis were selected for their relevance to this study. It was shown that the ODH may not be the most applicable theory for reading development, because of its proposal that there are two routes for reading. The PGST is preferred for explaining reading because it highlights the very important role of phonological processing in the acquisition of reading accuracy, suggesting only a single phonological route. This theory can easily be applied to different languages. PGST proposes that reading accuracy is attained through the development of efficient phonological recoding at different grain sizes.

The scope of this thesis is not to determine the grain size used by isiXhosa readers, but to gain a better understanding of phonological processing and its contribution to reading in isiXhosa. As Ziegler and Goswami (2005) suggest, reading acquisition can only be understood if phonological awareness development in the language is understood. Not much is known about phonological awareness in isiXhosa and other South African Bantu languages (de Vos *et al*. 2014). The findings from my study can then be used to inform future studies that wish to determine the grain size used by isiXhosa readers. This future finding could be used to inform teaching practice.

The DDH highlights the need to examine phonological processing: the components that are part of it and the tasks used to measure these components of phonological processing. PGST can easily be applied to explain reading in other languages, such as isiXhosa, but it does not adequately explain how the phonological processing components are involved in the use of grains of different sizes in phonological recoding. The understanding of reading becomes complicated when the importance of naming speed in dyslexic populations is emphasised. However, in Wolf and Bowers' (1999) DDH naming speed is hypothesised to measure something that is not only phonological. In order to get closer to a solution about this conflict, the two psycho-linguistic and cognitive skills in question, phonological awareness and naming speed, are addressed in the next section. At the end of the theoretical overview, the research questions and hypotheses for isiXhosa are presented.

2.6 Phonological Awareness

The realisation that phonological processing is essential for reading acquisition is supported by many years of research on phonological awareness (PA). PA is one of the components of phonological processing, along with short term verbal memory, and access of phonological representations for long term memory (Wagner & Torgesen 1987).

PA, also known as phonological sensitivity[4], is the awareness or sensitivity to the sounds and sound structure of a spoken language (Anthony *et al*. 2003, Adams 1990). The ability to identify and manipulate the sounds in words of a language has been widely accepted as one of the most

[4] I use the term phonological awareness since this is the most frequent term used in the literature. Nevertheless, the term 'sensitivity' more aptly defines the construct as it does not imply conscious knowledge of phonological structures, which 'awareness' does imply.

important predictors of reading success (Adams 1990, Stanovich 2000, Melby-Lervag *et al*. 2012). Already addressed is how PA takes a central role in PGST and a lack of PA is one of the core deficits proposed in the DDH.

PA is the 'umbrella term' (Stanovich 1987) which includes all the sensitivities to different units of sound: word awareness, syllable awareness, intra-syllabic awareness, and phoneme awareness (Adams 1990). Word awareness is the sensitivity that sounds in the speech stream can be broken down into words, such as knowing that *grasshopper* can be broken up (segmented) into the two words *grass* and *hopper*. Syllable awareness is the sensitivity to how words can be segmented into their constituent syllables, for example *grass* consists of one syllable /ɡɹɑːs/ and *hopper* consists of two syllables: /hɒp/ and /ə/. Intra-syllabic sensitivity is the knowledge that syllables consist of an onset and rime. For example, the onset of *grass* is /ɡɹ/ and the rime is /ɑːs/. Finally phoneme awareness is the sensitivity to the smallest units of sound, the phoneme. An example of phoneme awareness is the ability to decompose *grass* into its constituent phonemes: /ɡ/ /ɹ/ /ɑː/ /s/. These different levels of phonological awareness develop over time as well as with exposure to print.

2.6.1 The development of phonological awareness

Ziegler and Goswami (2005), in their Psycholinguistic Grain Size Theory, argue that understanding reading acquisition begins with understanding the development of PA. This view is tenable considering the central role of PA in reading acquisition. This section documents the development of PA.

The development of PA and its role in reading acquisition and success (or failure) has been studied in a number of languages including, but not limited to: English, German, Dutch, French, Portuguese, Spanish and Italian, Finnish, Greek, Turkish, Hungarian, Hebrew, Chinese, Japanese (kana), Sepedi, Setswana and Herero. Although the majority of findings are based on English, there appears to be similar findings, even in languages which are quite dissimilar in phonological structure to English (Ziegler & Goswami 2005).

Research shows that phonological awareness develops from the sensitivity of larger sound units which are easier to perceive in the speech stream such as the word and syllable to increasingly smaller units of sound such as the phoneme (Anthony *et al*. 2003, Anthony & Francis 2005, Cassady *et al*. 2008,). Most researchers agree that phoneme awareness only develops as a result of learning to read (Shankweiler & Fowler 2004) (although see Hulme *et al*. (2005)) for a different argument). There is evidence that illiterate people cannot easily manipulate the phonemes in words (Morais *et al*. 1979). A study of 30 illiterate Portuguese speaking adults and 30 Portuguese adults who only learned to read after age 15 showed that exposure to literacy influences the speaker's sensitivity to the smallest units of sound, the phoneme. Morais *et al*. (1979) administered phoneme addition and deletion tasks of words and nonwords. Results showed that although some of the illiterate participants could perform some of the tasks, the literate group outperformed them: for example in the nonword deletion and addition the illiterate group's mean scores for both addition and deletion were 19% whereas the literate grouped scored on average 71% and 73% respectively on these tasks. Studies on pre-reading children (Liberman *et al*. 1974) and adults who do not read an alphabetic orthography (Read *et al*. 1986) also support the view that phoneme awareness only develops as a consequence of alphabetic reading instruction because of the focus on the letter as representing the phoneme. However, there are some researchers who argue that sensitivity to the phoneme can be attained in preliterate children who speak a language with a complex phonology that has many consonant clusters. This is addressed in the next section.

The above-mentioned studies provide evidence that the acquisition of literacy boosts a speaker's sensitivity to the individual sounds in words. It appears that a "catalyst" is necessary to increase sensitivity to phonemes (Shankweiler & Fowler 2004: 487). For example, the illiterate participants in the study by Morais *et al*. (1979) did show some phoneme awareness, but this was nowhere as good as their literate counterparts. The catalyst in this case is exposure to an alphabetic writing system, especially letter knowledge and grapheme-phoneme correspondences. Alphabetic writing is based on the principle that letters (or groups of letters) represent individual sounds of the oral language (Wagner & Torgesen 1987). A certain level of phoneme awareness or sensitivity is needed so that the speaker grasps the alphabetic principle – that letters represent sounds systematically. The speaker/reader with phoneme awareness can exploit the letter-sound correspondences to begin reading. Furthermore, with each successful decoding of a word, the speaker/hearer's phoneme awareness is further consolidated (Share 1995), revealing the bidirectional link between phoneme awareness and literacy (Adams 1990). However, the speaker/reader who started off with low levels of phoneme sensitivity will take longer to discover the systematicity of the writing system because they struggle to learn and exploit letter-sound relationships (Ziegler & Goswami 2005). Further evidence for the relationship between phoneme awareness and reading shows that speakers who are specifically trained in phoneme awareness tasks improve in their reading abilities (Scheule & Boudreau 2008).

Longitudinal studies, or cross-sectional studies on children which vary in age, are used to determine the development of phonological awareness. With regards to Bantu languages, there is limited research on phonological awareness and the available research has relatively small sample sizes. Nevertheless, the available research (on isiXhosa and Sepedi) presents convincing evidence that syllables are acquired before phonemes, evidenced by higher scores on syllable tasks than phoneme tasks (Wilsenach 2013, Diemer *et al*. 2015), thereby following the trend described in the literature.

In summary, with a few exceptions (addressed in §2.6.3), it is apparent that PA develops from the sensitivity of larger units to smaller units. There is a bidirectional link between phoneme awareness and reading: the sensitivity to phonemes (the smallest sound unit) is encouraged through the acquisition of reading, but higher levels of phoneme awareness improve reading. Thus it is not surprising that PA is affected by the orthography being read (addressed in §2.6.4). We now have a conceptual definition of phonological awareness. The only way to gauge speakers' sensitivity to the sound structure of their language, however, is to measure it. The next section provides the operational definition of PA.

2.6.2 The measurement of phonological awareness

There are a number of task types and variations of these tasks which are used to measure PA. These tasks range in their difficulty because they place different cognitive loads on participants (Yopp 1988). There is also an interaction between the cognitive difficulty of the task, and the linguistic difficulty of the stimulus (Anthony *et al*. 2003). That is to say, in order to get variability in the results from the tasks it is important to use tasks that are neither too easy (producing ceiling effects) nor too difficult (producing floor effects) for the relevant linguistic unit. The choice of using a particular task is therefore dependent on the age and reading experience of the child, and thought must be given to include the best tasks for the aims of one's study.

Speakers develop in their ability to perform increasingly complex tasks on increasingly smaller units of sound. As speakers develop cognitively, they are able to perform increasingly explicit tasks from first identifying sounds of different sizes to tasks which require a number of manipulations (Anthony & Francis 2005). Research has shown that PA tasks range in their difficulty where those that require simple processing, such as same or different categorisations (e.g. do *sun* and *soup* start with the same sound?) are easier than those that require complex operations such as deleting a segment from a stimulus and saying the remainder (e.g. say *slat* without /l/) (Adams 1990).

The cognitive tasks used to measure speakers' sensitivity to the sounds in their language ask participants to perform the following operations:

- blending (adding sounds together to make a word): what word does /k/ /æ/ /t/ make?
- segmenting (breaking words into segments of the required size): tap out the sounds in /kæt/
- identification (identifying the sound in question): what is the last sound in /kæt/?
- addition (adding a sound to the word and saying the new word): what word is /kæb/ with /s/ in front?
- deletion also called elision (removing a sound from a word and saying the remainder): say /skæb/ without /s/
- substitution (the deletion and then replacement of the relevant sound in a word then saying the new word): say /pæt/ but instead of /p/ say /b/

There are a number of variations of each task which are employed to suit the context by making the task more or less explicit. For example, a segmenting task administered to young children could include tapping out the sounds to ease the cognitive load, whereas for older children, tapping would not be used as a method to help solve the task (Liberman *et al*. 1974). Another option is to keep the task requirements implicit i.e. children only have to point out the difference but not say what the difference is, which is more explicit e.g. in an identification task: do *fish* and *fan* start the same? (Adams 1990). There are many more variations but since this thesis examines the phonological awareness of Grade 3 learners, there is not much need to examine all the different types of variations. Only those suitably difficult for this older sample are needed.

As mentioned earlier, there is an interaction between task difficulty and linguistic difficulty (Anthony *et al*. 2003). This means that, on the same task, performance will drop as the linguistic difficulty increases, for example on a deletion task, the best scores will be achieved when manipulating words (because this is an easy unit to manipulate) and phonemes should get the worst score. On the other hand, keeping the size of the linguistic unit constant, performance will decrease as phonological awareness tasks increase in their cognitive difficulty, for example, when targeting phonemes, performance should be best on a blending task, with intermediate performance on an addition task, and the worst performance on a substitution task because the tasks become cognitively more difficult to complete. This means that a great deal of thought must go into considering what tasks and linguistic units will be appropriate for a given population in order to get variability in the results. This interaction is visually displayed in Figure 2.

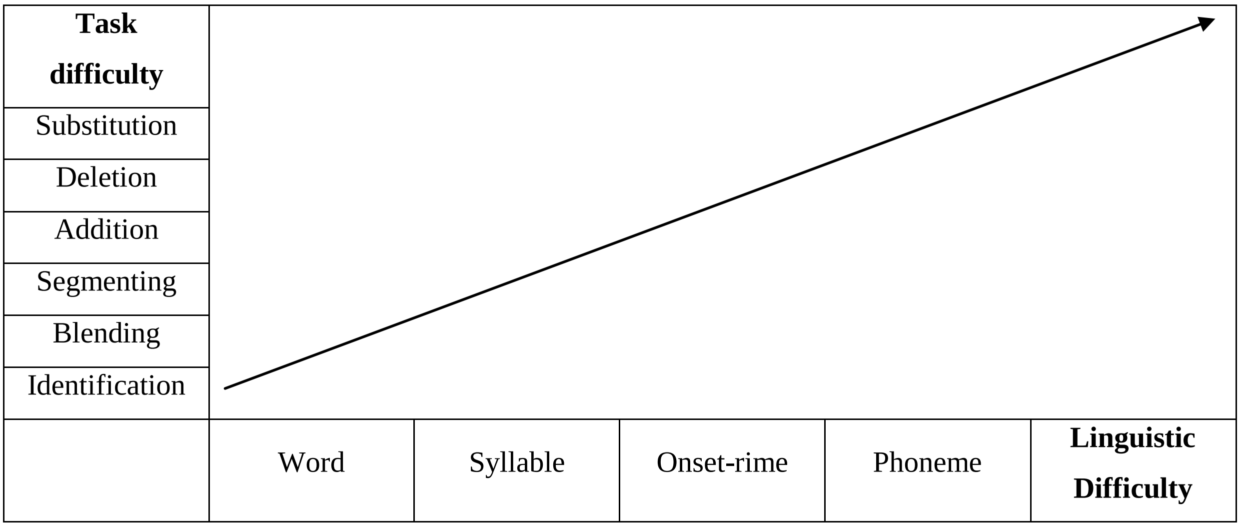


Figure 2: Development of phonological awareness (adapted from Adams 1990 and Schaefer *et al*. 2009)

Linguistic difficulty also refers to the type of stimuli used for the tasks. Stimuli are traditionally monosyllabic of a CVC structure. Complexity can be increased with the inclusion of clusters in the onset or coda, where languages allow this. Word length generally increases difficulty on the task because there are more units to pay attention to (Schaefer *et al*. 2009, Saiegh-Haddad *et al*. 2010). Researchers have also found that stress plays a role where stressed syllables are easier to manipulate than unstressed ones (Saiegh-Haddad *et al*. 2010). Phonological awareness tasks have traditionally used real words which are highly imageable (can be easily pictured), such as nouns (Ziegler & Goswami 2005). However, with the realisation that semantics and word frequency may affect performance, there has been a move to using nonwords to attain a more stringent phonological measure.

With reference to the administration of tasks, phonological awareness tasks are always presented orally and require an oral response. Pictures of the stimuli may be used to ease cognitive demands for younger children. Traditionally, phonological awareness tasks are untimed. However, with criticism that readers of a transparent orthography reach ceiling on phonological awareness measures quite early in development resulting in a lack of variability, there has been a move to timed measures (Caravolas & Landerl 2010, Moll *et al*. 2014). In this way, a latency and accuracy score can be attained for phonological awareness.

The conceptual definition of PA informs its operational definition (Table 3). It is, therefore, very important, when interpreting a study to determine how researchers have operationalised PA. For example, most studies operationalise PA as performance on a phoneme deletion task (e.g. Moll *et* *al*. (2014)) but in Wilsenach (2013) PA is operationalised as syllable deletion, which is an easier task because the syllable is a bigger sound unit. In generalising across studies, it is important to establish that the relevant studies measured PA in the same way, because of how linguistic unit and task interact.

Table 3. Schematic of phonological awareness: conceptual definition, operational definition, and how it is measured

Conceptual Definition	**Operational Definition**	**Measure**
Which informs the operational definition →	Which informs the development of the measure →	
Sensitivity to the sound structure of one's language. Ability to identify and manipulate the sounds in one's language. A phonological processing component.	The accuracy (and/or speed) with which one manipulates phonological units accurately	The type of task targeting a particular linguistic unit. e.g. Deletion task: oral instructions, oral response

The measurement of PA therefore requires an understanding of what is appropriate for a given population in terms of task and linguistic unit difficulty. There are a number of standardised tests of PA which are used for diagnosis and screening, mostly in English. However, no such standardised tests have yet been developed for isiXhosa, or other Bantu languages. The following sections provide more detail about how phonological representations and performance on PA tasks are affected by language-specific considerations and orthographic consistency.

2.6.3 Language-specific effects on phonological awareness - availability

Because PA is part of phonological processing – and is one of the abilities used in processing oral and written language – it stands to reason that it is also influenced by aspects of one's oral language, specifically phonology. The phonology of a language may encourage speakers to have better phonological representations of some units over others. This is what Ziegler and Goswami refer to as the 'availability' problem in reading. (Note however, that cross-language comparisons are being made here. It is mostly accepted that within a single language, awareness to larger units will occur before awareness to smaller units.)

The syllable structure of a language affects PA. For example, speakers of languages which have a more open syllable structure and limited vowel repertoires, such as Italian, Greek and Turkish, develop better sensitivity to the syllable as a unit because of a clearly defined beginning and end of the syllable with few consonant clusters (Cossu *et al*. 1988, Anthony & Francis 2005). English, which has a number of allowable syllable shapes, did not have this advantage. However, English readers are primed to be more aware of the onset rime level, that is, they are able to easily manipulate C-VC units because of the large number of rhyming words in the language. Further evidence for the language-specific influences on PA come from research on Hebrew, which show that when manipulating phonemes in monosyllables, speakers have a preference for body-coda representations, i.e. CV-C (Saiegh-Haddad *et al*. 2010). Deletion of final consonants is therefore much easier for Hebrew speakers, than it is for English speakers.

The variety, frequency and complexity of consonant clusters can also affect speakers' sensitivity to phonemes in clusters, either in the onset or coda, even before print exposure. Caravolas and Bruck (1993) examined the ability of Czech and English speaking monolingual 3-6 year olds' performance on a sound isolation task (what is the first sound of /mæb/?). Czech allows a variety of consonant clusters in the onset, which also occur quite frequently in the language. The phonotactics in Czech allow a large number of variations within these onset consonant clusters such that the same sound can occur as the initial consonant ([pr]), second consonant ([spr]) or third consonant ([fspl]) in the onset cluster. In comparison, although English does allow complex onsets, the frequency and variety is much lower than in Czech (31 vs 258 allowable onset clusters). For example, in English, /p/ only occurs first in a cluster with /ɹ/ and /l/. English has the phonological property that a large number of monosyllabic words share a rime, and usually after deleting a simple onset consonant, will produce that rime.

Caravolas and Bruck (1993) found that the oral language speakers were exposed to influenced their ability to isolate the first consonant (singleton and in a cluster) of monosyllabic nonwords. Czech speaking children were better able to isolate the first consonant in a complex onset than their English counterparts, even before literacy acquisition. This is because Czech has a high frequency of complex consonant clusters where the same sound can occur in different positions. This boosted the Czech speakers' awareness of sounds in clusters. In comparison, English speakers were better at isolating the fist consonant if it was a singleton consonant, rather than in a cluster. Firstly, this result is due to the fact that consonant clusters are less common in English than in Czech. Secondly, English speakers are encouraged by the phonology of English to pay more attention to onsets and rimes, given the large number of rhyming words. They are therefore able to isolate the singleton consonants more easily.

In another study on the effect of syllable structure on PA, Caravolas and Landerl (2010) compared the phoneme isolation abilities of pre-readers and readers in German and Czech. They found that speakers' ability to isolate phonemes in simple and complex onsets and codas mirrored the syllable structure of the two languages. Czech has many more complex onsets (which are more frequent), and fewer codas, while German has fewer complex onsets and many complex codas (onsets and codas occur with similar frequency). Comparisons within each language revealed that Czech speakers were faster and more accurate in isolating consonants in onsets than codas, whereas German speakers showed similar performance on isolating consonants in onsets and codas, although slightly more accurate with codas. Comparisons across languages showed that Czech speakers were better at isolating consonants in onsets than the German speakers, and German speakers were better at isolating consonants in codas than the Czech speakers.

The findings of these studies point out how the oral input which speakers receive encourage speakers to be more aware of some sounds over others. These studies also provide evidence that phoneme awareness can arise before formal reading instruction because speakers must pay attention to small changes in highly frequent consonant clusters. In isiXhosa, there are limited consonant clusters. It can be hypothesised that phoneme awareness only develops with exposure to print. On the other hand, the syllable awareness of isiXhosa speakers should be quite high because of the high frequency of clearly defined open syllables. Another language-specific factor which may affect PA is the morphological structure of the language.

Oktay and Aktan (2002) found that morphological changes, as well as phonological characteristics, that take place in Turkish cued speakers to pay attention to particular sound units in the language. Firstly, Turkish speakers are encouraged to become sensitive to phonemes because of vowel harmony. With some exceptions, vowels following the vowel in the first syllable harmonise with the first syllable. In terms of morphology, Turkish is an agglutinating language in which affixes are added to root morphemes. There is variation in the suffixes which are attached to roots, and affixation can cause changes in the root morpheme (e.g. *kita**p*** (*book*) changes to *kita**b**im* (my book)). Oktay and Aktan (2002) examined the phonological awareness abilities of kindergarten and Grade 1 monolingual Turkish and English speaking children. Turkish speakers outperformed English speakers on phoneme tapping. This is because Turkish speakers are accustomed to paying attention to individual phonemes, such as vowels when vowel harmony takes place, a process which does not take place in English. Furthermore, Turkish speakers were much better at deleting the final consonant of a CVC nonword than their English counterparts because the final consonant of the root is where morphological changes take place in Turkish.

The influence of morphology on PA was also identified in isiXhosa. Diemer *et al*. (2015) found that when Grade 3 isiXhosa speakers performed a substitution task on two syllable real verbs, they could more easily substitute the second syllable than the first. This was explained with reference to the verbal morphology of isiXhosa where affixation targets the final syllable, thereby encouraging speakers to pay attention to this part of the word. However, even with affixation before the root morpheme, changes are never made to the first syllable of the root. Although Diemer *et al* (2015) used real words, Oktay and Aktan (2002) used nonwords as stimuli in their study. These two studies indicate then that morphology does influence phonological awareness, regardless of the words used as stimuli.

This section highlighted that speakers' PA is influenced by the language that they speak. The next section addresses the role of orthography, specifically its consistency, in restructuring phonological representations.

2.6.4 Orthographic influence on phonological awareness

There are also orthographic influences on PA, in terms of the speed of developing phoneme awareness, and in its effects on the responses to PA tasks.

Orthographic transparency, the extent to which the same sound always represents the same letter, is another factor that influences phonological awareness because of the reciprocal relationship between PA and literacy. Of course, the influence of orthography on PA begins when children learn to read.

A certain level of phonological awareness is available to pre-readers, but learning to read an alphabetic script further enhances phoneme awareness because the orthography encourages awareness to phonemes (Ziegler & Goswami 2005). Because orthographies vary in the consistency with which the same phonemes are represented by the same letters, children learning to read a consistent orthography reach higher levels of phoneme awareness earlier than their peers who learn to read an opaque orthography. The PA (specifically phoneme awareness) of readers of a consistent orthography improves more because the same letters always cue to the same sound, enabling the reader to learn about phonemes, and letter sound mappings, reliably. Their reading is more accurate from the onset of reading instruction, thereby helping to cement their phoneme awareness. On the other hand, in an inconsistent orthography the same letter (or letter groups) represents a number of sounds, and the same sound can be represented by a number of different letters, thereby making it more difficult for the reader to learn about the phonemes reliably.

The influence of orthographic consistency on PA has resulted in the measurement characteristics that the role of PA for reading is most important and useful in the early grades for consistent orthographies, but remains a good predictor of reading up until the later grades for readers of an opaque orthography (Moll *et al*. 2014). This is because readers of a consistent orthography reach high levels of phonological awareness and become accurate readers early in instruction, but readers of an opaque orthography take longer to learn about the phoneme, and take about 3 years to reach the same accuracy as readers of a consistent orthography (Seymour *et al*. 2003). Georgiou *et al*. (2008) therefore recommend that sufficiently difficult PA tasks be used for readers of a consistent orthography in order to produce variability in the results.

It is also important to consider how orthographic representations of sounds may influence the speaker's responses on phonological awareness tasks. With reading experience and learning the letter-sound mappings, speakers develop orthographic representations of sounds, which affects how they perceive these sound (Castles *et al*. 2010). Share (2008: 597) summarises a number of studies which have found that adults rely on spelling to solve PA tasks. For example, adults were better able to delete phonemes when that phoneme is spelled with a single letter (e.g. in American English: "raft without /f/ is rat") than when the distinction is less clear (e.g. in American English: "mixed /mikst/ without /k/ is mist"). Orthographic influences may also be dependent on the PA abilities of the group. Landerl *et al*. (1996) found that the orthographic representation of words intruded on the responses of children with 'normal' levels of phonological awareness, whereas dyslexic children (who by definition have a phonological deficit) showed lower incidence of orthographic influence in their responses. The implication of this orthographic influence is that PA tasks that will be used for screening or diagnosis should only use stimuli which have 1:1 letter to sound correspondences; otherwise orthography will influence the results.

Finally, researchers should be aware of how sounds are orthographically represented in the language in order to include the correct instructions (Diemer *et al*. 2015). Greenop (2004) created a phoneme deletion task for use with Northern Sotho speakers but did not take the orthographic representation of individual phonemes into account. For example, she instructed participants to delete /t/ from *motho* /mot^{h}o/, and supplied the correct response as /moho/. This error in task development is caused by a misunderstanding about what letter groups represent in Northern Sotho. In this case, it is impossible to delete /t/ from *motho* because this sound does not exist in the word. Rather, *th* is a digraph which represents a single sound /t^{h}/. It is therefore important to be aware of how phonemes are represented by single letters, and by letter groups in a language when developing phonological awareness tasks.

2.6.5 What is phonological awareness used for?

PA is needed to establish letter-sound correspondences which are used in decoding (Castles *et al*. 2010, Moll *et al*. 2014). Without adequate levels of phonological, specifically phoneme, awareness readers cannot develop accurate phonology-orthography correspondences. Sound-letter correspondences are essential for the development of phonological recoding (Ziegler & Goswami 2005). Efficient phonological recoding is important for accurate reading. All three reading theories covered in the previous section place emphasis on phonological awareness: the ODH on its role in the phonological route, PGST on its role in phonological recoding at various grain sizes, and the DDH for its role in accuracy with letter-sound correspondences. With specific reference to PGST, PA is involved at the level of phonology, because of its implication in sensitivity to the available sounds in one's language.

Phoneme awareness has been reported as a good predictor of word and nonword reading accuracy (Caravolas *et al*. 2005, Moll *et al*. 2014), although only when sufficiently difficult tasks are used when measuring PA in consistent orthographies. Interestingly, a study by Ziegler *et al*. (2010) found that phonological awareness also predicted word and nonword reading speed of Grade 2 learners in a number of languages that ranged in transparency. Ziegler *et al*. (2010) argued that because they measured PA in Grade 2, children were still developing their PA, which is why it also predicted reading speed. Because of its link to accuracy, PA is also a good predictor of reading comprehension (Wolf & Bowers 1999). Finally, because of its role in establishing letter-sound correspondences, PA is also important for the acquisition of spelling (Moll *et al*. 2009).

This section provided an overview of PA and described its importance to reading. A good understanding of PA is essential to understanding reading because of the emphasis placed on phonological processing in learning to read and becoming a skilled reader. Yet to be addressed is the second important variable for reading, according to the DDH, called naming speed.

2.7 Naming Speed

Naming speed (NS) is the second independent variable of concern in this study. NS is usually measured with a serial Rapid Automatized Naming (RAN) Task (Denckla & Rudel 1976a) and is operationalised as the time taken to name aloud a set of serially presented familiar stimuli (Wolf 1991, Wolf *et al*. 2000, Kirby *et al*. 2010, Norton & Wolf 2012). What NS measures at the underlying level is still debated (Georgiou & Parrila 2013). That is to say, the conceptual definition of the construct that NS is an indicator of has yet to be established. Table 4 shows how the research on NS began with the RAN task, which fed into the operational definition. As more research is done cross-linguistically, different conceptualisations of the construct underlying naming speed have arisen.

Table 4. Schematic representation of naming speed as a construct

Conceptual Definition	**Operational Definition**	**Measure**
	Will inform the conceptual ⟵ definition	Informed the operational ⟵ definition
Debated: ? Phonological processing (speed of lexical retrieval) ? Orthographic processing (ability to form orthographic representations/ automaticity of orthography-phonology correspondences) ? Articulation and serial processing	The time it takes to read out a set of serially presented familiar stimuli.	Rapid Automatized Naming Task of: - letters - digits - objects - colours

Clarifying the conceptual definition of NS is out of the scope of this dissertation. Rather, the dissertation seeks to determine the relationship of NS to PA, reading speed, reading accuracy, comprehension and spelling in order to shed some light on what NS could be measuring, primarily if it is something phonological. The discussion on NS begins with a description of the measure that is traditionally used to assess speed of naming, the RAN Task. Following this, three conceptual definitions of the construct underlying NS are addressed because they are relevant to the PGST and the DDH views of reading. Finally, the role of NS in reading is addressed.

2.7.1 The measurement of naming speed

The importance of NS for reading was first discovered by Geschwind (1965) who developed a timed test of colour naming. Geschwind (1965) noted that alexic patients named colours very slowly, as well as struggled with reading by definition. He hypothesized that the relationship between NS and reading is an indication that they both require the same processes: paying attention to abstract visual symbols, presented serially, matching them to their phonological representation and saying this out loud.

Denckla (1972) then Denckla and Rudel (1974, 1976a, 1976b) explored this hypothesis further, finding that dyslexic readers performed more poorly on these naming tasks than other 'normal' readers. They created what they termed RAN tasks where colours, objects, numbers and letters are used as stimuli. The RAN task consists of a chosen number (usually 5 or 6) of stimuli (either colours, familiar object drawings, numbers or lower case letters) that are repeated randomly over five rows for a total of 50 stimuli. For example, the digit RAN task consisted of the numbers 2, 4, 6, 7 and 9, and the letter RAN task consisted of the letters *p, o, d, a* and *s*. Visually confusing pairs, i.e. 6 and 9, *p* and *d* were included so that namers who could not recognize these visual stimuli automatically could be identified. Stimuli are read serially from left to right and the time taken to name all the stimuli (the naming latency) is used for later analysis (Denckla & Rudel 1976b). Because the recognition of stimuli is automatized participants usually do not make any errors. However, Kirby *et al*. (2010) suggest that naming latency be converted into the number of correct stimuli named per unit of time, thereby giving a more valid measure, as there are surely cases where errors occur, due to slips of the tongue.

Because of the use of line drawn objects, colours, numbers and digits, the RAN task can easily be used in other languages using the exact same RAN format and the same stimuli. The researcher must be cautious however in their interpretation of their results when comparing across languages, especially for languages which are structurally different from English, for which there is much research. This is because languages have different names for the colours, objects, and digits which may vary in syllable length, complexity and word frequency. In fact, some languages may not have two different words for two different colours. For example, Georgiou *et al*. (2008) measured RAN with a traditional 50 stimuli format using colours (red, blue, green, black and yellow), and digits (2, 3, 4, 5, 7, and 8) in Greek speaking and English speaking monolinguals. They found that for colour names, the Greek version of the task had on average considerably more phonemes than the English version (5.6 vs 3.6 phonemes respectively). Of course, this problem only arises if one compares across languages. Georgiou *et al*. (2008) overcame the differences in tasks by determining the relationship between NS and reading in each language separately. Once they had determined the role of NS to reading, they then made a comparison between Greek and English in terms of the relationship to reading, rather than the raw score from the RAN task.

These tasks and different versions of them are still used in current research. For this reason, NS is also often called rapid automatized naming. In this study, the preferred term is naming speed because a RAN task is not the only measure that can be used to measure the time it takes to name stimuli, neither is naming always 'rapid' (Kirby *et al*. 2010). In order to establish why NS is related to reading, different versions of the RAN tasks have been developed. Covering all these tasks in detail is out of the scope of the dissertation, so they are only named here. In contrast to the serial naming task addressed above, a discrete-trial naming task has also been developed. In this version, participants must name the stimulus individually (Wolf 1991). Naming is timed per stimulus and latencies are averaged. This version does not have as strong a relationship to reading as the serial RAN task. Other methods include using the traditional RAN format, but measuring pause time (time in between responses) and articulation time (the time it takes to name the stimulus), to determine what component of the serial naming task is important for reading (Georgiou *et al*. 2014). Articulation time indicates familiarity with the stimulus, and pause time indicates how fast phonological codes can be accessed (Georgiou *et al*. 2014). After examining the different versions available, it seems that the traditional format of RAN is much simpler to administer and interpret.

The next section explores the evidence for the relationship between naming speed and reading, which informs current conceptual definitions, which are addressed in the following section.

2.7.2 The relationship between naming speed and reading abilities

NS is important for reading where automaticity (manifested as speed) is involved (Wolf & Bowers 1999, Norton & Wolf 2012, Georgiou *et al*. 2014, Moll *et al*. 2014). That is to say, NS correlates well with, and is predictive of the reading fluency of words, nonwords and texts, and through its relationship to fluency, is also related to reading comprehension. There is also evidence to show that it correlates with real word reading accuracy (Kirby *et al*. 2010). Research has shown that the strength of the relationship between NS and reading varies by the type of stimuli used, type of naming speed task, age, reading ability and orthographic consistency of the language of the reader (Georgiou & Parrila 2013).

2.7.2.1 Type of stimuli

Research with NS and its relation to reading has shown that RAN tasks using alpha-numeric stimuli (digits and letters) are more related to reading (or predict reading better) than the non-alphanumeric stimuli (colours and objects) (Denckla & Rudel 1976b, see Kirby *et al*. 2010) for a review). There are a number of reasons for this finding: alphanumeric stimuli come from a closed class, with few members and have mostly unambiguous names, which make it easier to recognize them automatically (Kirby *et al*. 2010). On the other hand, non-alphanumeric stimuli come from an open class which means there are more members, and they have less well-defined names (think of *blue* which can be identified as *blue*, *light blue, indigo, teal*, etc.). Secondly, the naming of objects and colours also requires access to semantics (Georgiou *et al*. 2014).

It is therefore important to assess which stimuli were used when interpreting the results of a RAN task. It is sometimes unavoidable to use non-alphanumeric RAN with pre-readers or children who have not yet reached automaticity in recognizing alphanumeric stimuli.

2.7.2.2 Type of naming speed task

Research has also shown that serial continuous naming tasks show stronger correlations with reading fluency and are better predictors than the discrete or articulation/pause time measures. This is because the continuous serial version shares more with reading in terms of the processes involved. In a way, the serial RAN task mimics oral reading: the eyes must focus on visual stimuli, process the orthography-phonology correspondences, pronounce the correct phonological string, and makes saccades to the next stimulus in a left to right fashion (Norton & Wolf 2012). For this process to succeed in reading or RAN, automaticity in the individual processes is essential. In this way, RAN tasks are a "mircocosm of reading" (Wolf & Bowers 1999: 418). The key difference between reading and RAN is the involvement of processes used for comprehension which is used in reading.

2.7.2.3 Age, reading ability and development over time

Researchers have also explored how the relationship between NS and reading changes over time, as a function of age and reading experience. There is evidence to support the idea that RAN is a better predictor of reading in the later grades or as reading experience increases (Vaessen & Blomert 2010). Some have theorised that this is because RAN is a measure of word-specific orthographic representations: more experienced readers have built up orthographic representations of words which help them read more fluently. However, in Vaessen and Blomert's (2010) study on Dutch readers, RAN had a significant strong relationship between both real word and nonword reading leading them to conclude that naming speed is probably a measure of the automaticity with which phonological codes are found for orthographic strings, or the retrieval of phonological codes from memory (in line with the conceptual definition of Wagner & Torgesen (1987)).

To complicate this matter, there is a body of research that shows that NS is more strongly related to reading measures administered to poor readers (such as those with dyslexia) than with unselected or 'normal' readers (Wolf & Bowers 1999, Kirby *et al*. 2010, Norton & Wolf 2012, Georgiou & Parrila 2013). Johnston and Kirby (2006) split their sample of Grade 3, 4 and 5 learners into two groups: those who performed above the median ('good readers') and those who performed below it ('bad readers'). RAN predicted comprehension ability only for the poor reader group. This study and others, leads Kirby *et al*. (2010: 348) to conclude that the development of NS may be curvilinear: "steep at lower levels of ability, and flatter at higher levels".

This section highlighted that NS develops over time, but also may play more of a role in predicting the reading of poor readers. There is also research to show that the role of NS may be more important for reading in transparent rather than opaque orthographies.

2.7.2.4 Orthographic consistency

The effect of orthographic consistency on NS and its role to reading is still debated. Some researchers claim that orthographic consistency affects the relationship between NS and reading, especially the age that NS becomes important for reading, and others claim that the influence of NS is not affected by orthographic consistency per se. However, when looking at the effect of orthographic consistency on NS and its relationship to reading, is not so much about the relationship of NS to reading, but of the relative contribution of NS to reading as compared to the role of phonological awareness.

The debate about whether the influence of NS varies by orthography is partly due to the undecided conceptual definition, or critiques of how NS and PA are measured in the different orthographies. Georgiou *et al*. (2008) explain that if NS measures a component of phonological processing, it should have a stronger relationship to reading in a consistent orthography, because of the reliance on small grain sizes at the letter-phoneme level. Efficient reading is based on the automaticity of these small grain sizes. However, in an inconsistent orthography, efficient reading results from use of multiple grain sizes, where the role of orthographic processing becomes more important. If NS is a measure of the successful development of orthographic representations, then it should have a stronger relationship to reading in an inconsistent orthography, where larger grain sizes need to be used. Regardless of the conceptual definitions and their predictions, various results have been found.

In §2.6 it was discovered that PA decreases in its ability to be a good predictor of reading in transparent orthographies because PA reaches high levels of accuracy sooner, whereas PA continues to be a good predictor of reading in opaque orthographies (Georgiou *et al*. 2008). With reference to this changing relationship, it has been found that NS is a better predictor of reading ability in a transparent orthography than that for an opaque orthography (de Jong & van der Leij 1999). This is because PA reaches ceiling levels earlier and ceases to be a predictor of reading fluency in a transparent orthography. Thus, NS is left to 'soak up' the remaining unexplained variance. However, researchers have argued that the exaggerated role of NS to reading in transparent orthographies is because PA was measured with accuracy and not time. When a timed measure of PA is used for readers of a transparent orthography, the result is that PA continues to be a good predictor of reading; consequently, the role of NS is less exaggerated and is equal across orthographies varying in transparency (Ziegler *et al*. 2010).

In their study of Grade 1 and 2 Greek and English speaking monolinguals, Georgiou *et al*. (2008) found that NS predicted the same reading abilities in the transparent and opaque orthographies. Digit naming predicted nonword reading ability equally. Nonword reading relies heavily on phonological processing. If NS were a phonological measure, it should be more related to nonword reading in the transparent orthography, but it was not. Similarly, if NS is a measure of orthographic processing it should relate more to word reading in an opaque orthography. In fact, they found that NS had a stronger relationship with word reading for the Greek participants, leading Georgiou *et al*. (2008) to conclude uncertainty in their choice of definition.

Perhaps Georgiou *et al*. (2008) were incorrect in their interpretation. The fact that NS predicted nonword reading equally in both languages can be interpreted as readers relying on a small grain size strategy to read nonwords. Using a small grain size strategy to read nonwords can be expected, especially since participants were in the beginning stages of reading, being in Grade 1 and 2, so English readers may not have developed efficient use of large grain sizes. Since NS predicted nonword reading fluency, this may support the phonological processing account of RAN. When it came to word reading, the Greek speakers clearly relied on a small grain size strategy because of the stronger link to NS, but in English there was no significant relationship, indicating the use of larger grain sizes. The results of this study suggest that NS does play different roles to reading abilities depending on the orthographic consistency.

On the other hand, Vaessen *et al*. (2010) found that the role of PA and NS to reading in different orthographies shared a similar pattern, but that the strength of the relationship to reading was affected by orthographic depth. They discovered the pattern that PA was important in all grades, but decreased in strength as grade increased, whereas the contribution of NS increased across grades. Vaessen *et al*. (2010) examined the development of four skills (phonological awareness, naming speed, letter-speech sound processing and verbal working memory, in a very large sample of Grade 1 – 4 children (unselected for reading ability)). Children were monolingual speaker/readers of Hungarian, Dutch and Portuguese where Hungarian was most transparent, Portuguese most opaque and Dutch in the middle. Examination of the mean scores on rapid naming of digits showed that for each grade, the digit naming latencies were very similar in the orthographies (e,g, Grade 1 digit naming was 1.5 (Hungarian), 1.5 (Dutch) and 1.3 (Portuguese)), but increased similarly as grade increased. With reference to the contribution of NS to reading, Vaessen *et al*. (2010) concluded that NS did not vary by orthographic consistency, but rather with reading development. They remark that "the gradually increasing relationship between rapid naming and reading fluency possibly reflects an increasing role of efficient matching of visual/orthographic and phonological information in fluent reading" (Vaessen *et al*. 2010: 837), which they emphasize appears in all orthographies.

The results of Vaessen *et al*. (2010) are convincing because they examined the roles of PA and NS over four grades, from the early stages of reading to more skilled reading in Grade 4. In fact, research on Finnish, Hungarian, German, French and English normal readers in Grade 2 – 7, also found that the predictive patterns of NS to reading abilities is similar across orthographies (i.e. that the strength of the relationship changes over grade) but the relationships are strongest in English. Interestingly, in this sample of readers unselected for reading ability, the prediction of NS for Finnish reading fluency, the most transparent orthography studied, was very small, and similar in size to the contributions of phonological awareness and naming speed. However, NS deficits have been found in poor readers of Finnish, highlighting that the contribution of NS influenced by reading ability, especially in very transparent orthographies (Moll *et al*. 2014).

In summary, conflicting findings have been found about the influence of orthographic consistency on naming speed's relation to reading. However, there seems to be more convincing evidence from those who conclude that NS is not affected by orthographic consistency since they studied large samples of children in many grades, reading a number of different languages. We also see, however, that the interpretation of findings regarding naming speed's role to reading is complicated in that a number of factors influence the relationship. This section pointed out these factors to be: the type of stimuli used in rapid naming tasks (whether alpha-numeric or not), the type of naming speed task (where continuous tasks relate more to reading), age or reading development (where NS has a stronger contribution to reading in the later grades), reading ability (NS seems to predict reading better for poor readers than readers unselected for reading ability), but NS is not affected by orthographic consistency.

The following section outlines some of the conceptual definitions of the construct that RAN tasks measure. Although there are a number of proffered interpretations, only the phonological and orthographic definitions are provided since they are specifically relevant to this study. As mentioned previously, determining the underlying construct that naming speed is a measure of is out of the scope of this dissertation. Rather, the scope of this dissertation is to determine the role that naming speed plays in isiXhosa reading.

2.7.3 Theoretical interpretations: why does naming speed contribute to reading?

Consensus has not yet been reached about what exactly a RAN task measures (Wolf 1991, Wolf *et al*. 2000, Kirby *et al*. 2010, Norton & Wolf 2012). Understanding the different interpretations of why NS is linked to reading rests on an understanding of what processes are shared between naming and reading. A recent study on the neural networks shared by RAN and reading showed that RAN activates regions in the brain that have been implicated in grapheme-phoneme mapping, phonological processing, semantic processing, and articulation and motoric processes (Cummine *et al*. 2015). Theories of the RAN-reading relationship tend to focus on one of the shared features to explain the relationship.

Recall from earlier that NS measures can be considered a "microcosm of reading" (Wolf & Bowers 1999: 418) because naming and reading out loud recruit a number of the same attentional, perceptual, cognitive, articulatory and linguistic processes (Wolf *et al*. 2000). Wolf and Bowers (1999) explain the requirements for the successful naming of letter stimuli:

(1) "**attention** to the letter stimulus"
(2) "bihemispheric, **visual processes** that are responsible for initial feature detection, visual discrimination, and letter and letter-pattern identification"
(3) "**integration** of visual feature and pattern information with **stored orthographic representations**"
(4) "**integration** of visual information with **stored phonological representations**"
(5) "**access** and **retrieval** of **phonological labels**"
(6) "activation and integration of **semantic and conceptual information** and "
(7) "motoric activation leading to **articulation.**" (page 418; emphasis added)

Wolf *et al*. (2000) further emphasize that processing speed is involved at each step. Successful naming and successful reading both rely on the efficient and automatic integration of processes at and between each step (Wolf & Bowers 1999, Kirby *et al*. 2010, Norton & Wolf 2012).

Nevertheless, naming speed is not reading. The two tasks seem to share a number of processes but which aspects account for the relationship between reading and naming is open for interpretation, and is not yet agreed upon. Theories have been developed which explain the RAN-reading relationship. Only three of these are presented below: one interpretation which focuses on the shared phonological components, one on the shared orthographic requirements, and one on the shared articulation and serial processing requirements. These interpretations are explained in §§2.7.3.1, 2.7.3.2 and 2.7.3.3 respectively.

2.7.3.1 Emphasis on phonological components

This view of NS emphasises the shared phonological processes of naming and reading (Wagner *et al*. 1993), specifically through access and rate of access to the phonological representations of letters, letter groups, parts of words or entire words in long term memory (Wagner & Torgesen 1987). This conception of NS emphasises the shared relationship to reading as outlined in step 5 and 7 on page 51. Thus, NS measures one of the three phonological processes used for the processing of oral and written information.

If NS measures the rate of access to and retrieval of stored phonological representations in long term memory, and is therefore one of the three phonological processing abilities, there should be a close relationship between NS and other phonological processes, such as phonological awareness and phonological short term memory (also called verbal working memory) (Wolf *et al*. 2000). There would also be concern as to whether NS explains any variance after other phonological processing has been accounted for (Kirby *et al*. 2010). Furthermore, like the other phonological processing ability, phonological awareness, NS should correlate well with nonword reading (Kirby *et al*. 2010).

Wolf *et al*. (2000) criticise the phonological processing account: firstly as simplistic, and secondly for not accounting for the evidence. Wolf *et al*. (2000) acknowledge that there are shared phonological requirements between reading and NS, but emphasise that the processes involved in naming are much more complex than only these phonological processes. Secondly, NS provides its own independent contribution to reading, which is not accounted for by PA, and correlates only moderately with PA. The evidence shows that NS continues to explain reading after PA, and other skills, have been controlled for, indicating that NS explains something in addition to the phonological processing explained by PA (Norton & Wolf 2012). Vellutino, Fletcher, Snowling and Scanlon (2004, cited in Moll *et al*. 2009), in line with the phonological processing conceptualisation, suggest that PA may measure accuracy of phonological processing and NS may measure speed of phonological processing. However, Moll *et al*. (2009) found that when including a speeded measure of PA, NS still contributed a significant amount of variance to reading ability over and above this speeded PA measure.

Furthermore, NS and PA account for different reading abilities, where NS accounts for word reading speed/fluency and PA for accuracy. NS and PA correlate only moderately with each other. A meta-analyses of the relation between naming speed and phoneme awareness (as measured with deletion) reveals a moderate correlation between the two in English (Swanson *et al*. 2003, Melby-Lervag *et al*. 2012). Moll *et al*. (2014) report correlations between digit naming and phoneme deletion as very weak and non-significant in English, French, German and Portuguese, reaching significance in a weak correlation of r = .13 for Finnish.

Thus, although NS and PA share some variance (evidenced by their correlations), these range from weak to moderate, indicating that NS is not only phonological. In addition, NS predicts different reading variables. It would be expected that similar constructs predict similar variables, but even after controlling for PA, NS accounts for variance in reading.

2.7.3.2 Emphasis on orthographic components

Another interpretation of the link between NS and reading emphasises the shared orthographic requirements of the tasks. This interpretation is presumably based on steps 2 and 3 of the process of naming on page 51. Two explanations that link NS to orthographic processing are provided here. The first view explains NS as necessary to build up orthographic representations of words while the second view emphasises the automaticity of orthography-phonology correspondences.

One view is that NS is necessary to develop orthographic knowledge: recognising letter groups or whole words as a single unit i.e. not grapheme-phoneme correspondences (Kirby *et al*. 2010). This leads to sight word reading. However, this view can be refuted with evidence that NS has a similar contribution to reading fluency in all orthographies, as reviewed earlier. Inconsistent orthographies encourage a visual-orthographic route (in line with the ODH), or the use of larger grain sizes (larger phonological units mapped to larger orthographic units, in line with PGST), but the contribution of NS to reading fluency is similar across orthographies. Furthermore, NS was shown to predict both real word and nonword reading in German (Moll *et al*. 2009). If NS measured orthographic representations of words then it should have been more related to real word reading.

Moll *et al*. (2009: 22), after considering and refuting a number of possibilities, suggest that NS is linked to reading because it is a measure of the "**automaticity** of orthography-phonology associations at the letter and letter cluster level" (emphasis added). In their study of about 1200 German speaking Grade 3 and 4 learners, they found that NS predicted variance in real and nonword reading fluency over and above that of orthographic processing and phonological awareness. The strength of the contribution of NS to both real word and nonword reading lead them to refute the 'traditional' view of orthographic processing as an explanation for the relationship. Since PA was not a predictor of nonword reading, because high levels had been achieved in the consistent German orthography, the main difference in ability was fluency: the fluency (or automaticity) with which readers could recognise the letters, and convert them into their phonological counterparts and synthesise this into the nonwords. The finding that NS was as strong a predictor for word reading could be because of the use of small grain sizes in reading, even for real words in German (Ziegler *et al*. 2001). Because NS made an equal contribution to real and nonword reading, Moll *et al*. (2009) suggested that NS may be related to reading because they both require efficient integration of visual-verbal processing.

2.7.3.3 Emphasis on shared articulation and serial processing

In another view of the relationship between NS and reading, research by Georgiou *et al.* (2016) showed that NS may be linked to reading not because of shared phonological or orthographic processing, but because of the shared articulation and serial processing requirements between the two.

Georgiou *et al.* (2016) examined the phoneme deletion, speed of processing, orthographic processing, rapid naming, word reading fluency and text reading fluency of 102 Chinese, 117 English and 85 Finnish speaking children in Grade 4.In their path model they found that RAN made a direct and independent contribution to reading fluency, which was not accounted for by either phonological or orthographic processing in the three languages. Fluency in all three languages (which varied in consistency) was similarly directly affected by RAN. RAN did not have an influence on spelling. Georgiou et al. (2016) concluded that the shared requirements of articulation and serial processing are responsible for the RAN-reading relationship.

2.7.3.4 The role of naming speed in PGST

As discussed previously, the PGS Theory does not specifically describe how NS is involved in reading at the different grain sizes. It is clear that the role of NS within the PGST cannot be decided until a conceptual definition of NS has been reached.

It seems that Ziegler and Goswami (2005) subsume NS under phonological processing. In this case, NS would be involved in the phonology part of developing a grain size (in blue in Figure 3). However, if naming speed is related to reading because of its role in orthographic knowledge, then its involvement would be at the orthography level of a grain (in yellow). Finally, if NS measures the automaticity of orthography-phonology correspondences, PGST could explain that NS indicates how automatic readers are at corresponding the orthographic units to phonological units of whichever size. This could also explain why some readers can be highly accurate but slow at reading, even in a transparent orthography. Furthermore, this conceptual definition also accounts for why NS is a good predictor of reading in both transparent and opaque orthographies, because they both make use of orthography-phonology correspondences.

There are a number of other conceptual definitions that have been provided for the link between reading and NS, but only the three most relevant to the current study have been described. Data from my study on text reading fluency and accuracy can tentatively suggest whether PA and NS are both phonological, or whether NS measures orthographic processing, or the automaticity of orthography-phonology correspondences. In the final section of Chapter 2, what is known about literacy, and the roles of PA and NS in Bantu languages is addressed.

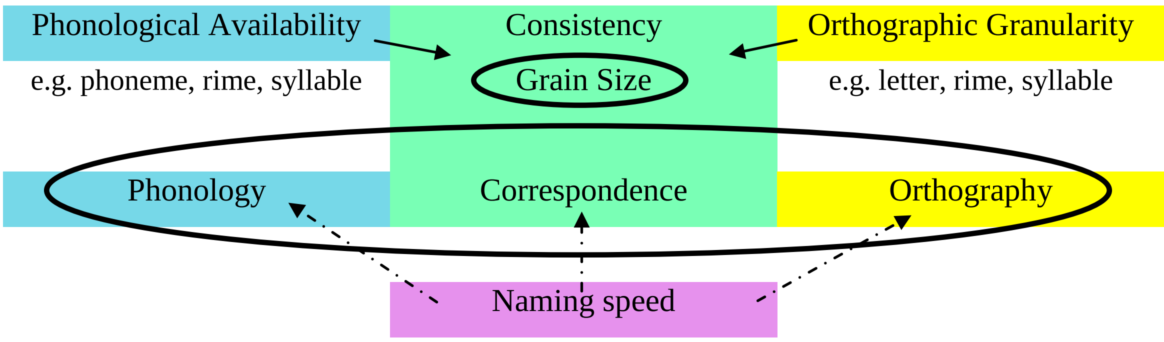


Figure 3. The hypothetical involvement of naming speed in reading at different grain sizes

2.8 Literacy in Bantu languages

Research on Bantu languages has shown that phonological processing, as measured by PA, is important for reading, but the role of NS is less clear. The available research on Bantu languages is reviewed here and its relevance to my study is made clear. This discussion leads into the hypotheses I make for what might be found in isiXhosa. Although the studies are done on a number of different languages I argue that these languages are similar enough to make comparisons and inform the interpretation of the data from my study. Caution in interpretation must be advised as some of the studies report on the phonological awareness levels of bilingual children who may or may not be learning how to read in both languages.

The general trend in the available literature on Bantu language literacy is that PA correlates well with word reading, and remains a significant predictor after accounting for variables such as IQ and phonological working memory. NS appears not to be a large contributor but does predict some reading ability.

A study conducted on a very small sample of first grade Sepedi speakers suggests that syllable awareness correlates with word reading ability (Pretorius & Mokhwesana 2009). The study by Pretorius and Mokhwesana (2009) used a syllable deletion task (deleting either the first second or third syllable from a nonword) as one of their measures to track the progress in a literacy intervention. The intervention included resource building at the school library, creating print rich environments in the classroom, running workshops for teachers focussed on the teaching of reading, and parent workshops where they were informed about the importance of reading and how to read stories to their children. They found that the syllable awareness of Grade 1 learners steadily improved as the intervention progressed. This suggests that the exposure to print and improved teaching methods improved syllable awareness. Secondly, a Spearman rank order correlation showed a significant moderate correlation with word recognition ($r_{(s)} = .67$, $p <.001$).

In another small sample, the phoneme deletion abilities of Setswana Grade 2 children predicted a large amount of variance in word and nonword reading abilities (Lekgoko & Winskel 2008). After controlling for age and letter knowledge (which contributed no unique variance), phoneme deletion accounted for 22% and 24% of word and nonword reading fluency respectively. Data from larger samples also shows that phonological awareness has a positive relationship with reading ability.

Malda *et al*. (2014) compared the PA skills of 358 English, Afrikaans and Setswana Grade 3 children learning in English, Afrikaans or Setswana. Focusing only on the Setswana group, PA (measured by phoneme blending, segmenting and deletion) was a good predictor of their reading fluency (a composite score made of words correct per minute on word and text reading). Malda *et al*. (2014) expressed their surprise at this finding, especially considering that the literature suggests that PA tends to reach high levels in readers of a transparent orthography and therefore ceases to predict their reading ability. They concluded that the relationship was found because the reading skills of the Setswana group were not yet well developed. For this reason, PA continues to predict reading fluency.

Diemer *et al*. (2015) also examined phoneme blending and segmenting, but in isiXhosa. They also targeted syllables, and included a substitution task. In their sample of Grade 4 learners they found that phoneme segmenting was very difficult, and even phoneme blending was not at ceiling levels. They did not correlate these results with a reading measure and they had a sample of about 30 children, but it is not difficult to conceive that the large amount of variation in the results could correspond to their reading abilities. Alcock *et al*. (2010) also found phoneme segmenting to be very difficult for Kiswahili children in grades 1 and 2. They argued that this is a result of teaching methods which do not focus on the phoneme, or teach letter – sound correspondences at the phoneme level. If letter–sound correspondences are not taught at the phoneme level, it may take learners longer to establish their phoneme awareness, especially since this type of instruction further improves phoneme awareness levels. A lack of automaticity in letter-sound-correspondence recognition will lead to the slower recognition of words which will have a negative impact on reading fluency (Ashby *et al*. 2013). I also argue that the continued development in phonological awareness may reflect the fact that isiXhosa readers must learn a large number of correspondences. The large number of correspondences, coupled with teaching methods which may not always focus on the phoneme, could explain the continued trend of development.

In a study of bilingual Herero-English Grade 2 to 5 children, Veii and Everatt (2005) found that phoneme recognition accounted for 16% of the variance in word reading ability after accounting for sex, age, grade, school and IQ. Naming speed contributed 2% after PA was accounted for. Naming speed was measured by object and colour naming which has been shown to contribute less to overall reading ability. If digit naming had been used, NS may have contributed more to word reading accuracy. The English reading abilities and PA of the children were also measured. Veii and Everatt (2005) noted that equal amounts of variance were accounted for in both languages. Other research shows however that more variance should be accounted for in the transparent orthography. However, the predictions were equivalent. They explained this finding by referring to the reading development of the children. Their data showed that the variability in reading ability of the children, even in the transparently written Herero, suggested that children were still developing their abilities, even by grade 5. Data from children learning to read transparent orthographies in Europe show that reading accuracy reaches ceiling levels from a very young age. Veii and Everatt (2005: 250) further explain that the lack of ceiling effects may be a result of teaching policy in the schools in Namibia where children are “left to work out recoding strategies for themselves” rather than having teaching instruction explicitly teach reading strategies at particular grain sizes. They also conceded that the variability may be due to individual differences in the children.

Reported studies do not usually include measures of comprehension. One study which did, by Malda *et al*. (2014) found that the comprehension levels of the Setswana group was quite low. As a result, PA was not a good predictor of comprehension. The low result in comprehension could be due either to how it was measured in the study (multiple choice questions following a text), or an actual reflection of the comprehension abilities of the participants. Malda *et al*. (2014) suggest that their low levels of comprehension may be because these learners had not mastered the lower level, more basic decoding process, which lead to comprehension abilities.

Spelling has been shown to be directly related to phonological representations, as well as being influenced by morphological and grammatical knowledge (Alcock & Ngorosho 2003). Alcock and Ngorosho (2003) examined the spelling abilities of 41 Kiswahili speaking children in Grades 2 to 5. They discovered that spelling in a transparent orthography is also difficult. They report that the participants were generally accurate with mean scores across grades ranging from 70 – 89% accuracy in real word spelling in texts. They did not include a measure of PA. It would be worthwhile to examine the contribution of PA to spelling in Bantu languages.

Some studies address the characteristics of reading in Bantu languages. Data from eye movement studies shed light on the differences in reading found between English and isiZulu. Land (2015) examined the eye movements of adult isiZulu readers (who can also speak and read English fluently). She compared her findings to what has been reported for reading in other alphabetic languages. Her results suggested that reading in isiZulu is slower. There are longer and more frequent fixations compared to other languages which suggest that isiZulu readers take more time to process what they fixate on. The length of saccades is generally shorter indicating that readers process less in each fixation than other readers of alphabetic languages. Land (2015) concluded that these characteristics suggest that adult isiZulu readers rely on a small grain size to read, which explains why they read slower, and take longer to process each fixation. This finding could also suggest that early readers of isiZulu may also rely on a small grain size. This is especially true as Ziegler and Goswami (2005) argue that larger grain sizes develop over time with reading experience. Since adult readers seem to rely on a small grain size, this suggests that beginner readers do too.

The study by Lekgoko and Winskel (2008) on Grade 2 Setswana readers in Botswana provide evidence that young readers rely on a small grain size. In their study, participants reading of words and nonwords correlated at .99 and the contribution of phoneme deletion to reading words and nonwords was almost equal (22 vs 24%). Similarity between the word and nonword reading indicates that the same strategy is used to read both types of words. Since nonwords are not real words, they can only be decoded using a small grain size.

2.8.1 Summary

In summary, the available data on Bantu language literacy research shows that phonological processing, as measured by PA tasks, is important for word, nonword and text reading. There is evidence from a single study that NS also accounts for variance in word reading accuracy in Herero. There is evidence to suggest that phonological skills and reading do not develop as fast as the literature on other transparent orthographies would suggest. A recurring suggestion is that this finding can be attributed to teaching methods which do not focus on the phoneme level. Finally, data from adult readers suggest that Southern Bantu readers use a small grain size in their reading. For this reason, it may be the case that both PA and NS are good predictors of reading in isiXhosa. PA is essential for establishing letter-sound correspondences which are used in grapheme-phoneme conversion at a small grain size. If NS measures the speed at which orthography-phonology correspondences are retrieved it will be very important for reading in isiXhosa because of the number of orthography-phonology correspondences that will need to be made for reading with a small grain size. The current study can add to this growing body of literature on the requirements of reading in a Southern Bantu language.

2.9 Conclusion

Chapter 2 presented selective literature that outlined the roles of PA and NS and their relation to reading in cross-linguistic studies.

Reading was described as consisting of two parts, both of which rely on a number of processes. These two parts are phonological recoding which is necessary for word recognition, and comprehension which is the goal of reading. The central role of phonological processing for reading acquisition was highlighted. Three reading theories were presented which address the role of phonological processing in word recognition.

The Orthographic Depth Hypothesis proposed a two route model: where a phonological route predominates in shallow orthographies and a visual-orthographic route predominates in deep orthographies. This theory, by proposing two routes, detracts from the importance of phonological awareness. Another theory, the Psycholinguistic Grain Size Theory proposes only one phonological route. PGST proposes that readers acquire reading through the use of psycholinguistic grain sizes. A grain is a phonology-orthography correspondence. Grain sizes are developed by solving the three problems of reading: availability in the phonological system, granularity in the orthography, and the correspondences between the two. Finally the Double Deficit Hypothesis places emphasis on a second variable for explaining reading – that of naming speed. It was suggested that if naming speed is shown to explain reading as well as phonological awareness then there is a need for PGST to specify how naming speed is involved in the development of grain sizes. I look at the variables of phonological awareness and naming speed in isiXhosa reading to determine if the predictions of PGST and DDG apply. Analysis of my data will enable me to provide suggestions for improving PGST.

The two variables highlighted by PGST and DDH, phonological awareness and naming speed, respectively, were addressed in detail. Finally their roles in Bantu languages were examined. The findings confirm that phonological processing (phonological awareness) is important for reading in Bantu languages but also highlighted a gap. The characteristics of phonological awareness in isiXhosa and other related languages have not been addressed in detail in the literature. This is especially alarming given that an understanding of phonological awareness development is essential for understanding reading acquisition. Even less is known about the role of naming speed in isiXhosa and other related languages.

There is therefore a clear gap in the knowledge about phonological awareness and naming speed in isiXhosa, and how they are related to different reading variables. The study presented in this dissertation provides an in-depth analysis of the phonological awareness abilities of Grade 3 isiXhosa readers, explores the relationship between naming speed and phonological awareness to tease out whether naming speed may be phonological in nature and finally the roles of naming speed to different reading variables in isiXhosa are addressed.

Chapter 3 outlines the method used in the study. The results are presented in Chapter 4, and the conclusions are stated in Chapter 5.

3 METHOD

3.1 Introduction

This cross-sectional study examined the role of two cognitive variables (phonological awareness and naming speed) to reading fluency, accuracy, comprehension and spelling ability of Grade 3 isiXhosa readers. The primary goal of this research was to provide insight into the cognitive variables underlying reading and spelling in isiXhosa. To meet this goal, the relevant contributions of phonological awareness and naming speed to various literacy skills (oral and silent reading, comprehension and spelling) in isiXhosa were measured. Because the measurement of these variables has not yet been standardised, it was necessary to develop these measures for isiXhosa based on the guidelines and best practice presented in literacy research. The specific linguistic structure of isiXhosa was considered in the development of these measures to ensure appropriate measurement.

The measures were used to answer the following research questions:

1. What are the phonological awareness levels of Grade 3 isiXhosa readers/speakers?
    a. What linguistic aspects of isiXhosa, or other factors, affect phonological awareness in isiXhosa?
    b. How best can phonological awareness be measured in isiXhosa?
2. What is the relationship between phonological awareness and naming speed in isiXhosa?
3. What is the contribution of phonological awareness and naming speed to reading fluency, comprehension and spelling in isiXhosa?
    a. How do these findings relate to the trends found in the literature?
    b. Based on 3a, do adaptations need to be made to PGST's conceptualisation of reading?

This chapter describes the method used to collect data for the study. The study sample (§3.2), the development of the tasks for this study (§3.4), as well as a detailed outline of the sampling, data collection and exclusion procedures (§3.5) are discussed. The development of PA tasks, how they were administered and how responses were coded, is addressed in detail (§3.4.2) so that other researchers can use the task for isiXhosa, or easily adapt the task for use in other Southern Bantu languages. I also created and used a coding system that reveals rich information about why errors were made on the tasks. An analysis of the errors on PA tasks has not been previously reported in the literature.

3.2 Participants

Participants, who were in Grade 3 at the time of the study, were drawn from three schools in the Eastern Cape. The sample was thus a convenience sample. The schools are part of an ongoing project with the English Language and Linguistics Department from Rhodes University. Participants were selected from Grade 3 since this is the last year of Foundation Phase which marks the end of the "learning to read" stage of school. Because this study aims to explore the relationship between two cognitive variables and reading ability, it is necessary that children have learnt to read.

IsiXhosa is used as the Language of Learning and Teaching (LOLT) at all schools and all the learners who participated are assumed to speak isiXhosa as a first language. These learners are from rural townships in small Eastern Cape coastal towns so isiXhosa as L1 can be assumed, unlike when participants are sampled from Gauteng where variation in L1s can be assumed. Participants' exposure to and use of English in daily activities varies but was not determined due to time constraints. However, at each school, English is used as the LOLT from Grade 4.

Data on the socioeconomic status of the participants who attend the schools, as well as the quintile status of schools was unavailable. I allow the reader to infer SES based on my observations reported below. As mentioned, each school is in a township situated in a small coastal town in the Eastern Cape, South Africa. These schools are in the same administrative district/municipality. Schools 1 and 3 are situated at the entrance to the townships, and school 2 is situated centrally within the township. The properties surrounding the schools are a mixture of tin shacks and small brick houses. Each school had a feeding scheme where learners received one warm meal during the school day. All schools consisted of brick buildings with two classes (of about 30 learners) per grade. The teachers were not always present in these classes, and there were only few posters in the classes, with only one school having books visible in the Grade 3 classrooms.

For reasons outlined in section 3.5.4, the original sample size of 93 participants was reduced to 52 participants. The characteristics of this smaller sample of 52 learners are reported in the remainder of this chapter. The remaining 52 learners are from 3 schools: 13 learners (25%) attend school 1, 28 learners (almost 54%) attend school 2, and 11 learners (almost 21%) attend school 3.The sample was balanced for sex: 24 learners (46.2%) are male and 28 learners (53.8%) are female. There is a fairly large age range for the learners: the youngest learner is 8;9 years old and the oldest learner is 12;10 years old. The mean age of learners at the time of testing was 10;8 years (*SD* = 11.85 months) suggesting a large amount of variability in the ages of children sampled in this study.

The current sample has a cohort of learners older than the legislated age would predict. South African legislation stipulates that learners should be enrolled in Grade 1 in the year s/he turns 7 (DBE 1998). This means that learners turn on average 9 years of age in Grade 3. Considering that participants were tested towards the end of the year, the legislated average should then be around 9;7 months give or take a year since you only have to “turn” 7 in Grade 1. The mean age of learners in my sample is therefore one SD older than the legislated average. It may be the case that learners in other South African schools are actually older than this legislated average either because of starting school late, or because of grade repetitions. Unfortunately, data about year of enrolment and number of grade repetitions was not available, making it difficult to group learners according to either criterion.

The learners in this sample may or may not be older than other learners in Grade 3 in similar schools in South Africa, and therefore may or may not be representative of the larger Grade 3 population of learners from township schools. Nevertheless, the current study seeks to determine whether there is a relationship between PA and NS. Once this is established, further research can tease out the role of other factors such as age or grade repetitions.

3.3 Ethical Considerations

Ethical clearance was granted to the Sandisa Imbeweu Literacy Project run by the English Language and Linguistics Department, by the Rhodes Ethics Committee.

Permission was granted for access to the classes by school principals and teachers, and access was renegotiated as the year went on, depending on other factors such as the Annual National Assessments.

Consent forms were sent to parents and guardians of children in these classes explaining the goals of the study and that participation of their child in the study was voluntary with no foreseen benefits or harm. Children only participated in the study if their parent or guardian had filled in this form. These children were selected from the classroom and the testing situation was explained to them. They were told that they could discontinue the session at any time without any repercussions. There were no instances of discontinuation by participants. Because the tasks part of the study were explained as games, the participants told positive stories to their class mates, which made them eager to participate in the study.

3.4 Measures

The variables of interest in this study are phonological awareness, naming speed, reading fluency, reading accuracy, comprehension and spelling. Some constructs were measured by more than one task.

Because reading in African languages in South Africa is under-researched, there are no standardized literacy related tests available (van Dulm & Southwood 2015). Based on a review of the literature, and keeping the structure of isiXhosa, the sample characteristics and time constraints in mind, appropriate tasks were developed to measure each variable. In this section, each task is discussed with reference to how it was developed, administered and scored.

3.4.1 Rapid Automatized Naming Task

Naming speed was measured by an adapted rapid automatized naming (RAN) of digits task (Compton *et al*. 2002). The adapted task measures the speed at which participants can rapidly and correctly name a set of five numbers (2, 4, 6, 7 and 9) in 15 seconds in isiXhosa.

3.4.1.1 Task Development

The RAN task created by Compton *et al*. (2002) was used in this study to measure the speed of digit naming. Compton *et al.* (2002) adapted the RAN task to an alternative format which requires participants to name stimuli for 15 seconds only. This alternative format of the RAN task consists of 15 rows of 5 stimuli and allows for the repetition of stimuli. In contrast, the traditional RAN task developed by Denckla and Rudel (1976a) consists of an array of five stimuli (either colours, familiar objects, letters or numbers) repeated randomly in five rows of ten. The RAN test is timed and the RAN score is the time taken to name all 50 stimuli. The adapted RAN task (Figure 4) was preferred because it is quicker to administer, and is therefore a better fit for time constraints in the testing situation. In addition, comparison of counterbalanced groups on the traditional RAN task and the alternative RAN task showed that the alternative RAN task was more related to word recognition (a measure of reading) than the traditional 50 item RAN task (Compton *et al*. 2002).

It is acknowledged that a full array of RAN tasks[5] should be employed to gain a more in-depth understanding of NS in isiXhosa. Future studies should consider employing a range of RAN tasks for this reason. However, the main goal of the current research is to gain a preliminary understanding of the role of NS in isiXhosa Grade 3 reading, and so only one RAN task was used. This decision was also motivated by the limited testing time.

2	6	9	4	7
2	2	4	7	9
6	2	4	7	6
9	4	7	2	6
2	2	2	7	9
9	9	6	9	6
4	7	7	2	6
9	6	9	9	2
2	6	9	2	2
7	7	2	4	6
6	9	9	2	6
2	2	7	6	9
2	6	9	2	9
7	4	7	9	6
4	4	7	4	4

Figure 4. The adapted RAN task

Alphanumeric stimuli, specifically digits, were chosen as stimuli for the task. Alphanumeric stimuli show stronger correlations to reading than objects or colour naming (Norton & Wolf 2012) and numbers were used because they can be unambiguously named. The numbers 2, 4, 6, 7, and 9 were used to match Denckla and Rudel's (1976a) task. Both six and nine are used because these numbers are similar in their shapes and easily confused for individuals who cannot automatically recognise them (Norton & Wolf 2012).

Letters could just as easily been used as stimuli but it is important to remember that the participants in this study are exposed to both English and isiXhosa and are not monolingual (participants in other RAN studies usually are monolingual). There is a need to elicit isiXhosa number naming from participants since the relation between isiXhosa number naming and reading is of interest in this study. Since it could be more difficult for participants to differentiate English letter naming from isiXhosa letter naming, it was decided to use numbers and then explicitly tell participants to name numbers in isiXhosa and not English. As can be seen in Table 5, isiXhosa numbers generally have more syllables than English numbers. If a fair comparison of RAN scores between participants is to be guaranteed, participants must name numbers only in isiXhosa. The fact that number names are different in each language (while the symbol remains the same) is

[5] These other RAN tasks could target objects and letters.

important to remember: the results of an isiXhosa RAN test cannot directly be directly compared to the results of a RAN test in another language if the number of syllables per number symbol is different. The task will reflect speed of naming, but this may be affected by the number of syllables or syllable complexity of the named numbers.

Table 5: Comparison of English and isiXhosa numbers

Number	English	Syllables	IsiXhosa	Syllables
1	one	1	nye inye	1 2
2	two	1	bini zimbini	2 3
3	three	1	thathu zinthathu	2 3
4	four	1	ne zine	1 2
5	five	1	hlanu zinhlanu	2 3
6	six	1	thandathu zinthandathu	3 4
7	seven	2	nxhe nxhenxhe zisinxhenxhe	1 2 3
8	eight	1	bhozo isibhozo	2 4
9	nine	1	thoba ithoba zilithoba	2 3 4

A second RAN task was developed for participants to practice on before the actual RAN task was administered. This practice board also enabled the researcher to identify participants who were not yet automatic in their number naming. The practice RAN board followed the same format as that described above but with the numbers 1, 3, 4, 8, and 9 as stimuli. In isiXhosa, the names of 1 (*nye*) and 4 (*ne*) can be easily confused since they are phonologically similar. In addition, numbers 3 and 8 may be confused visually to those participants who are very much not automatic in their naming. The number 9 was chosen since it is the very last digit and those participants who are not automatic may resort to counting until this number to name it, thereby indicating that they are not automatic. The practice board is a chance for the participant to become acquainted with the task, namely that they should read from left to right in a serial fashion and to then move to the next line and continue reading (Norton & Wolf 2012).

Furthermore, the digits 1 – 9 were printed on separate cards to be used in a test trial before the RAN practice task and actual RAN task were administered. As per Norton and Wolf’s (2012) recommendation, a test trial was included before the start of the actual RAN task to ensure that participants could automatically recognise the stimuli in isolation before doing the RAN task. In this way, participants who could not name numbers in isolation could be identified.

3.4.1.2 Task Administration and Scoring

The administration of the entire task and the participants' oral responses were recorded. The task began with an explanation. Participants were told that they were going to play a game with numbers. Participants were instructed to read the numbers in isiXhosa. See Appendix B for the administration instructions.

After the instructions had been administered, the trial numbers were presented to participants. The trial numbers were presented in the same order for each participant (1, 5, 7, 2, 9, 3, 6, 4, 8). Trial items were purposefully not given in numerical order: counting may be automatic while individual, context free, number naming may not be. Participants were asked to name the number in isiXhosa as the card was shown to them. If participants could not name the stimuli in isiXhosa, or if they made an error naming the test trial stimuli (including counting from 1 to the relevant number on their fingers), this was marked on the score sheet (Appendix C). The trial was not timed.

Participants were then presented the practice RAN task. The task administrator ensured that the participant understood to read from left to right and then continue on to the next line of numbers. This practice RAN task was not timed as the aim of the practice trial is to allow participants to feel comfortable with the format of the task.

After the practice trials, the actual RAN task was presented on a board and participants were asked to read the numbers as fast as possible. Participants were timed and were asked to stop naming after 15 seconds had passed from the moment they named the first number. The last number read within the time limit, as well as errors, omissions and any other comments were recorded on the score sheet (Appendix C). The errors included: omissions (where a number was not named), substitutions (where the incorrect number was named), using the fingers to count and English naming of numbers.

The RAN task, including instructions, the practice numbers trial, the practice RAN trial and the actual task took on average three minutes to administer.

The score sheets were checked by listening to the recordings of each participant and corrected if there were timing errors. The total number of words read in 15 seconds as well as the number of errors was recorded on the score sheet. The number of errors was subtracted from the total number of stimuli named to give a score for the number of stimuli named correctly. The score for number of stimuli named correctly was then transformed into an Items per Second score and this was used in later analyses.

3.4.2 Phonological Awareness Task

The phonological awareness task measures the ability of participants to segment, identify and delete syllables and phonemes of nonwords (Appendix D). The measure includes different task difficulties and linguistic units to determine participants' sensitivity to the sound structure of isiXhosa. The measure was developed in collaboration with a colleague, Tracy Probert, based on a previous measure of PA in isiXhosa (Diemer *et al*. 2015). The ideas for administration and coding presented below are solely mine. The PA measure is discussed with reference to task development, administration, and coding.

3.4.2.1 Task Development

The PA tasks developed for this study were specified according to the linguistic and cognitive complexity appropriate for isiXhosa and for Grade 3 learners respectively. This approach arises out of Anthony *et al*.'s (2003: 475) lament of phonological awareness research that "[f]ew studies have examined more than two levels of task complexity, and often when more than one level was examined it was confounded by differences in linguistic complexity". The PA task developed for this study required the manipulation of two linguistic units (the syllable and phoneme) at each of three cognitive task levels (segmenting, identification and deletion). In explaining how this task was developed, the linguistic units for manipulation are first specified and then a discussion of the task types follows[6].

3.4.2.1.1 Lingusitic Complexity

Following on from Diemer *et al* (2015) and Wilsenach (2013) the syllable and phoneme were selected as linguistic units of analysis appropriate for use with isiXhosa. Syllables are prominent and easily manipulated because of the mostly open syllable structure of Xhosa, (see §2.4.4) (Diemer *et al*. 2015). Phonemes were selected because of their relation to reading (Liberman *et al*. 1989, Adams 1990). The onset and rime were not selected as units of analysis because of the

[6] It is important to remember that even though linguistic unit and task type are separate components to a PA test, they interact in important ways that have to be considered. This interaction will be discussed in section 3.4.2.1.3.

few consonant clusters in onsets and the small number closed syllables in isiXhosa. Furthermore, how a word is defined in isiXhosa and other Southern Bantu languages is not clear cut (Myers 1987, Louwrens & Poulos 2006) so a PA task that manipulates the word as a linguistic unit in a PA task would not be appropriate. Since little is known about PA in isiXhosa, it was best to build on the small amount of knowledge there is about syllable and phoneme awareness in isiXhosa, providing more depth, rather than a cursory overview of awareness at different linguistic levels.

Nonwords (also known as pseudowords) were used in this study to give a truer PA measure that is not affected by the properties of real words such as word class, semantics or frequency of occurrence (Moll *et al*. 2014, Malda *et al*. 2014). The nonwords were developed for the tasks. The developed nonwords were checked by a first language speaker of isiXhosa to ensure their non word status. Half of the nonwords intentionally contained one sound segment that is spelled with more than one letter in the written language so that the effect of orthographic awareness on PA could be examined (e.g. in the phoneme identification task participants were required to delete /ɬ/ *hl* from /ɬenama/ *hlenama*). Landerl *et al*. (1996) found that 'normal' readers were more affected than dyslexic readers by the orthographic representation of sounds in PA tasks. Evidence from isiXhosa also showed that orthography may well affect children's ability to manipulate sounds, especially in a phoneme segmenting task where words have to be segmented into their constituent phonemes (which are sometimes spelled with multiple letters) (Diemer *et al*. 2015). Research in English also shows that orthography plays a role in sound awareness such as adults concluding that there are more sounds in *pitch* than *rich* because of the "t" even though they both have four sounds (Share 2008).

Furthermore, nonwords varied in length from two to four syllables long according to the complexity of the cognitive task. This interaction between linguistic and task complexity is discussed in section 3.4.2.1.3.

3.4.2.1.2 Cognitive Complexity

The tasks chosen for the PA test were segmenting, identification and deletion. They were chosen because they all require explicit manipulation of sounds (Schaefer, *et al*. 2009) but range in their difficulty where segmenting is easier than identification and deletion is the most difficult, at least for English (Anthony *et al*. 2003, Cassady *et al*. 2008).

Yopp (1988) also found that these three tasks were the most reliable. Yopp's (1988) study of about 100 kindergarten English speaking children revealed that phoneme awareness tasks can be broadly categorised into two types: simple and compound phonemic tasks. Both types of tasks require the explicit manipulation of sounds in a word. What differentiates the two types of tasks is the number of operations that are performed, and as a consequence, the load on working memory. Simple phoneme awareness tasks require only one operation i.e. to segment or isolate a sound. Compound phoneme awareness task require that an operation be performed, (such as identifying the first sound of /bofuka/), the stimulus must be held in working memory, and then another operation must be performed such as blending the remaining sounds of the word together and then saying the resulting word out loud (e.g. deleting the first sound of /bofuka/ to give /fuka/). Yopp (1988) found that a phoneme awareness tasks had greater predictive ability when a task from each type was included in a regression equation to predict word reading. For this reason, an isolation (also called identification) and deletion task are included as the simple and compound tasks respectively. Segmenting is also included because research on isiXhosa and Kiswahili show very low performance on the phoneme version (Alcock *et al*. 2010, Diemer *et al*. 2015).

Previous research in isiXhosa showed that *blending* (combining sounds into words, e.g. what word does /i/ /ka/ /ti/ make? /ikati/) of syllables and phonemes was very easy for Grade 4 learners (Diemer *et al*. 2015) so a blending task was not used in this study. However, segmenting tasks (breaking up the sounds in a word, e.g. what are the sounds in /igoba/? /i/ /g/ /o/ /b/ /a/) used by Diemer *et al* (2015) proved to be more difficult than blending. Interestingly, Diemer *et al*. (2015) found that the segmenting of syllables was slightly more difficult than syllable blending, but when it came to phoneme manipulation, segmenting phonemes was most difficult. A segmenting task was therefore chosen in order to discover more about this difference in difficulty with syllables and phonemes. The segmenting task requires the participant to segment a word into its syllables or phonemes (See Table 6 for more examples).

Because the segmenting task requires explicit manipulation of sound units that may be quite abstract, sock puppets were used to show the child how to segment the words into phonemes and syllables. A tortoise sock puppet was used to explain the syllable segmenting task. Participants were instructed that the tortoise talks slowly and were given examples. They were then asked how the tortoise would say the nonword, eliciting syllable segmenting. Participants open and closed their hand making the puppet "talk", for each syllable. For the phoneme segmenting, which requires segmenting at the smallest unit of sound, a robot puppet was used in the explanation. The robot puppet "speaks" even slower than the tortoise and was used to show how to segment the word into individual phonemes. The participant opened and closed their hand to indicate how the robot talks.

Originally the identification and deletion tasks also had explanations to help participants solve the task. The identification task was explained through using hopscotch, where one had to ‘jump’ to the sound in the word. For deletion, participants had to find the secret password to get into a cave by deleting a part of the word and saying what was left. The original PA test (presented in Appendix D) contained these instructions. However after administering the task to a small sample of the participants it was found that the extra ‘make believe’ instructions for identification and deletion impaired rather than enhanced understanding. For this reason the extra instructions for identification and deletion were removed. Participants understood the task through the examples.

It was decided that the cognitive tasks in this study should range in their difficulty. The most difficult phonological awareness task is a substitution task where participants are asked to delete a certain sound in the stimulus word and then replace it with another sound. However, Diemer *et al* (2015) found that this task was quite difficult for Grade 4 learners. It was decided that the task would also be too difficult for Grade 3 learners, who are younger and have less reading experience. Therefore, a deletion task was used in the current study. A deletion task requires the participant to delete a certain sound from the stimulus word and say what is left and is commonly used in reading research (Wilsenach 2013, Moll *et al*. 2014, Malda *et al*. 2014). This task works well for syllable deletion where deletion of the first, second or third syllable can be examined. On the other hand, however, phoneme deletion is more complicated. Because of the repeated CV structure of isiXhosa words, and the low frequency of consonant clusters, deletion of a phoneme within in a (non)word would result in an unpronounceable string. For example, if the participant is instructed to delete /k/ from /ikati/ the resulting word would be */iati/, which is not a legal word in isiXhosa because of its CV structure. The use of nonwords does not remove this problem. For example, if the participant is instructed to deleted /m/ from /foma/ the result would be */foa/, which is unpronounceable.

Thus, for isiXhosa, only the initial phoneme can be deleted in a phoneme deletion task in isiXhosa. For example, saying the nonword /foma/ without /f/ results in a legal nonword /oma/. Thus, only the initial phoneme was selected for deletion (because of the CV structure of isiXhosa words), but the first, second and third syllables are all candidates for syllable deletion (because the deletion of a syllable within a word preserves the CV structure, producing a legal nonword). See Table 6 for a summary.

Table 6: Characteristics of the phonological awareness task

Task	**Position of the unit**	**Linguistic Unit**	**Example Instruction**	**Correct Answer**
Segmenting	Of the whole word	Syllable	How would the tortoise say /vumaka/?	/vu/ /ma/ /ka/
		Phoneme	How would the robot say /foma/?	/f/ /o/ /m/ /a/
Identification	Of first, second or third syllable/ phoneme	Syllable	What's the second sound of /nilema/?	/le/
		Phoneme	What is the second sound of /t'olega/?	/o/
Deletion	Of first, second or third syllable	Syllable	Say /xawelo/ without /xa/	/welo/
	Of first phoneme	Phoneme	Say /logeka/ without /l/	/ogeka/

It was also necessary to have an intermediate cognitive difficulty. The identification task was chosen as it works well for isiXhosa. An identification task (also called sound isolation) requires the participant to identify the first, second or third 'sound' (either the phoneme or syllable in this case) of a word by naming the specified sound (e.g. what is the first sound of /foma/? /f/). This task is easier than a deletion task as it does not require the manipulation of the word, only identification of one unit (Yopp 1988). The identification task requires participants to identify the first, second or third unit in the word. In the phoneme task, the second unit is a vowel.

3.4.2.1.3 The interaction between linguistic and task complexity

The interaction between task and linguistic difficulty was also considered. The first factor is word length. Nonwords varied in length according to the complexity of the cognitive task (presented in Table 7). This decision to vary word length was reached because it is generally more difficult to perform operations on longer words because of constraints on working memory (Alloway *et al*. 2004, Gillon 2004). Thus, because manipulating syllables is relatively easy for isiXhosa speakers (Diemer *et al*. 2015) the segmenting task uses 3 and 4 syllable long nonwords. However, since phonemes are more difficult to manipulate in general, 2 and 3 syllable long nonwords are used. In keeping in line with other research on Bantu languages, namely Wilsenach (2013) for Sepedi, the other nonwords used in this study are all 3 syllables long and this is kept constant across linguistic units and tasks to ensure comparability between tasks and linguistic units. The benefit of three syllable long nonwords means that the first, second and third unit can be identified or deleted (except for phoneme deletion where only the first unit can be deleted, as explained in section 3.4.2.1.2). These decisions mean that the effect of word length and position of the unit in the word on phonological awareness abilities can be examined.

Table 7: Number of syllables per nonword

	Segmenting		**Identification**	**Deletion**
Number of **stimuli** per task	5	5	10	10
Word **length: syllable** tasks	3 syllables	4 syllables	3 syllables	3 syllables
Word **length: phoneme** tasks	2 syllables	3 syllables	3 syllables	3 syllables

3.4.2.2 Task Adminstration

The phonological awareness task was split into two testing stations grouped by linguistic unit i.e. in each testing session, the linguistic unit remained constant and each task of segmenting, identification and deletion was administered (Table 8). This decision was made to avoid any carry-over effects of linguistic units in the different tasks. Tasks were presented in the same order at each test station: segmenting, then identification followed by deletion. However, the order of syllable and phoneme stations was counterbalanced so that approximately half the participants did the syllable tasks first and half the participants did the phoneme tasks first. Thus, within testing stations the order of administration of the tasks remained the same, but across testing stations, half the participants did all the syllable tasks first (in order of segmenting, identification and deletion), and half the participants did the phoneme tasks first (in order of segmenting, identification and deletion).

Table 8. Syllable and phoneme task breakdown

	Test Station 1	**Test Station 2**
Linguistic Unit	Syllable	Phoneme
Task Order	1. Segmenting 2. Identification 3. Deletion	1. Segmenting 2. Identification 3. Deletion

The entire test was administered orally by first language isiXhosa research assistants[7] and required oral responses from participants. Each task was recorded. Only the segmenting task made use of props which were puppets of a tortoise and robot, explained in section 3.4.2.1.2, above.

[7] Section 3.5.2 addresses how research assistants were selected and trained.

Participants were told that they were going to play a game with words that they had never heard before and that there were no right or wrong answers. The research assistant then explained the tasks using two example words for each task. The child was then required to respond to ten stimuli for each task. No feedback was given to the participant with regard to whether their answer was correct or not, but their responses were acknowledged either by a nod of the head or a vocalised encouraging response for them to carry on. It was decided that two examples in the beginning of the test would be sufficient to enable the child to understand. Corrective feedback was not used because of time constraints.

For each stimulus, the research assistant said the nonword and the participant was asked to repeat it, similar to the method used by Wilsenach (2013). This measure was put in place to ensure that the child heard the same nonword as the one said by the research assistant (Caravolas & Bruck 1993). If the child pronounced the nonword incorrectly, the research assistant repeated the word until the participant repeated it correctly. The child was then asked to perform the cognitive task (segmenting, identification or deletion) on the relevant sound unit (the syllable or phoneme). The instructions used for the PA task can be found in Appendix D.

Children were aware of the unit under manipulation firstly because only one linguistic unit was manipulated at each testing station and secondly, the segmenting task showed them through use of the puppets explicitly which unit (syllable or phoneme) was relevant. The puppets were used for the segmenting task to show participants what sound unit was important. Puppets are very useful to model to participants which sound unit is relevant because it is difficult to explain what a syllable or phoneme is to a Grade 3. The puppets then served as a useful prop to help the children understand the task while also making the task more fun and game like.

Puppets were made from white socks which were painted to look like a tortoise and a robot for the syllable and phoneme segmenting tasks respectively. Thus, for the syllable segmenting, the research assistant explained to the child that "the tortoise speaks slowly and this is how the tortoise breaks up words". The research assistant would then move the puppet's 'mouth' while segmenting the nonwords into syllables (e.g. /bofuka/ into /bo/ /fu/ /ka/). The child was then encouraged to make use of the puppet in helping them "say the words like the tortoise would" i.e. syllable segmenting. For the phoneme segmenting task a robot puppet was used and once again the puppet's 'mouth' was moved each time a phoneme was segmented (e.g. /foma/ into /f/ /o/ /m/ /a/). The fact that the puppets looked different and 'spoke' differently helped participants understand that a different sound unit was being targeted at each test station. The tendency to use the incorrect size of sound unit is quantified in §4.5.3.

Responses were not scored on site, firstly because it could distract the participant while answering, and secondly this study requires more than just a score for ‘correct’ and ‘incorrect’ responses. Research assistants did not have enough time between responses to write down detailed responses that are required for this study. This warranted the use of recording equipment.

After testing, the recordings were listened to and participants’ exact responses transcribed. Responses were recorded in detail to allow for an in-depth analysis of responses.

3.4.2.3 Coding

Responses from the transcriptions were coded for quantitative analysis. Two coding systems were applied: one for recording the accuracy, and one for recording the types of errors made on the tasks. The former has not been reported yet in the literature.

Generally, researchers award one point per completely correct answer and convert this to a percentage correct score (e.g. Diemer *et al*. 2015, Wislenach 2013, Moll *et al*. 2014). This same procedure for recording accuracy was used in the current study. However, because phonological awareness is underresearched in isiXhosa, the decision was made to employ a more nuanced coding system as well. After examining the data, it became apparent that some responses were neither completely correct nor completely incorrect.

Another more nuanced coding system was created where responses that were ‘inbetween’ – neither completely correct or completely incorrect – could be differentiated from completely correct and incorrect responses. Furthermore, a close examination of the data revealed that responses were incorrect for different reasons, and resulted in different types of errors. An analysis of the two coding systems can be used to answer different questions. The two coding systems are expanded on further, below, but are summarised in Table 9 and exemplified in Table 11, on page 80.

As already described, the first type of coding follows the procedure already established in the literature (e.g. Wilsenach 2013, Moll *et al*. 2014). Responses are either completely correct (and it can be said that the participants completed the task using phonological awareness), or the response is incorrect. Responses were coded as correct if the correct operation was performed on the correct linguistic unit and the sounds of the correct unit matched that of the original stimulus. In this study, participants could score a maximum of 10 points and a minimum of 0 per sub-task. The scores were totalled and converted to a percentage correct score. Higher percentages indicate higher levels of PA and lower percentages indicate lower levels of PA.

Table 9: Summary of Phonological Awareness Coding Systems

Coding System	Description	Question
Accuracy as a percentage	Percentage correct score allowing for responses as either correct (1) or incorrect (0).	When solving the tasks with a purely phonological approach, how do participants perform on the different tasks with different lingusitic units?
Analysis of the Errors	Categorical coding system that classifies the types of errors made for 'inbetween' and incorrect responses.	What are the most common types of errors when responding to different phonological awareness tasks?

The second type of coding system, a categorical system, identified different categories of responses. The three broad categories of responses (correct responses, 'in-between' responses, and incorrect responses) were sub-categorised further.

3.4.2.3.1 Correct responses

Responses were indicated as correct when they matched the model answer completely in terms of the correct linguistic unit manipulated and the correct task completed (see Appendix D for more examples). For example, if the participant is instructed to perform syllable segmenting on the stimulus /letʃaja/ and responds /le/ /tʃa/ /ja/ then they have solved the task by using a phonological approach. More examples are provided in Table 10. There were no sub-categories for correct responses.

Table 10: Examples of correct responses

Linguistic Unit	Task	Instruction	Model Answer	Participant Response
Syllable	*Segmenting*	How would the tortoise say: *letshaya*?	*le-tsha-ya*	*le-tsha-ya*
	Identification	What is the second sound of *temala*?	*ma*	*ma*
	Deletion	Say *setika* without *se.*	*tika*	*tika*
Phoneme	*Segmenting*	How would the robot say: *gcena?*	*gc-e-n-a*	*gc-e-n-a*
	Identification	What is the first sound of *tyizena?*	*ty*	*ty*
	Deletion	Say *dlashaza* without *dl.*	*ashaza*	*ashaza*

The only exception was made for the phoneme segmenting subtask. For a number of participants it was difficult to determine whether letter names or letter sounds had been used for this task. For example, item 4.8. of the phoneme segmenting task requires participants to segment *dopike.* When segmenting, the correct response, using letter sounds, is [d], [o], [p], [i], [k], [e]. The problem arises when participants did not use letter sounds, but a mixture of letter names and sounds. This was particularly a problem for vowels where the letter "e" can be pronounced [e] (letter sound) or [iː] (letter name), which can be confused for the letter sound of "i". Thus, to avoid attenuating the phoneme segmenting scores, cases of using letter names were accepted as completely correct if the correct unit (phoneme) and correct task (segmenting) were completed.

3.4.2.3.2 The 'inbetween' responses

In a number of cases, responses were neither completely (in)correct and were different from the correct response in interesting ways. These 'in between' responses were further sub-categorised into: single sound substitution errors, orthographic interference errors, or if the incorrect linguistic unit was targeted.

3.4.2.3.2.1 Sound substitution

Some answers were correct in terms of the correct linguistic unit and task performed, but the participant had replaced a single sound in the response. For example, in the syllable segmenting task, participants are asked to segment [zaxeno] (*zarheno*) (correct response: [za], [xe], [no]). If the participant responded with [za], [xe], [**l**o]) they had successfully identified the syllable as the unit of manipulation and had successfully completed the segmenting task. However, one cannot say they have been completely successful in this PA task since they have substituted [n] for [l] even though they repeated the nonword correctly before the task began. The substitution of a consonant was coded as "c". Vowels were also substituted by participants. For example, in the phoneme segmenting task, [dopike] (*dopike*) was segmented as [d] [o] [p] [i] [k] [**o**] even though the nonword was correctly pronounced by the participants before the task. The substitution of a vowel was coded as "v". The substitution of more than one sound in the response was scored as an incorrect response (addressed in §3.4.2.3.3). For example if the response had been [za], [**ʃ**e], [**l**o], although the correct unit and task were performed, two sounds have been replaced.

As far as possible, the scoring must reflect different levels of phonological awareness. If participants substitute sounds in the nonword (even though they repeated the nonword correctly before the task) in their response, this means that in some way they are not phonologically aware. Furthermore, substituting two sounds shows less phonological abilities than substituting one sound. For this reason, the substitution of one sound and the substitution of two or more sounds are coded differently. A high number of sound substitutions indicate that participants either have low levels of phonological working memory (Alloway *et al*. 2004) or make genuine slips of the tongue in their responses.

3.4.2.3.2.2 Orthographic Influence

Orthographic awareness also affected participants' responses, especially in the phoneme segmenting task. What is meant by orthographic awareness is the participants' knowledge that sounds are represented by certain letters in isiXhosa. For example, a child who is orthographically aware knows that [ᶢǀ] is spelled *gc*. In some cases, this awareness of how the sounds are conventionally spelled lead to the words being segmented according to the letters in the word, and not the sounds that the letters represent. An example of an orthographic error is when [ᶢǀena] (*gcena*) is segmented into 5 sounds [g] [ǀ] [e] [n] [a] according to the orthography even though [ᶢǀ] is one sound. The child shows a large amount of metalinguistic awareness when segmenting according to the spelling because they could visualise how the nonword would be spelled. The orthographically aware participant understands that letters represent sounds of the language and have used this awareness to complete the phonological awareness task. This type of error also occurred in the phoneme identification task where the first sound of [cigeno] (*tyigeno*) was identified as [t], reflecting the spelling, rather than /c/ which is the sound *ty* represents. This error was coded as "w".

The effect of orthographic awareness on phonological awareness has been found before (Landerl *et al*. 1996). Research on readers in English showed that more phonologically aware readers are more likely to make orthographic errors in their responses on phonological awareness tasks, as compared to dyslexic readers who have a phonological deficit. Coding for this type of error would therefore shed light on whether some participants are more likely to have phonological deficits in this sample.

Nevertheless, if there was influence of orthography in the participant's responses, this response was not coded as completely correct, but rather 'in-between' because they were correct in that the relevant task was completed but a letter and not a sound was the selected linguistic unit. This type of error is also interesting because of the bidirectional relationship between orthography and phonological awareness. It may be of interest to see the relationship between this type of error and reading ability, especially because 1) better readers have better phonological awareness, and 2) better readers have higher levels of orthographic awareness. It may be found that the number of orthographic errors (made in the phonological awareness tasks) is positively related to the number of words read. However, because the influence comes through in the form of an error, it may be the case that phonological awareness and orthographic errors are negatively related i.e. as orthographic errors increase, the score for phonological awareness decreases.

3.4.2.3.2.3 Incorrect linguistic unit

In some cases, the responses were incorrect because participants targeted linguistic units either too big or too small for the task. For example, in the phoneme identification task when asked to identify the first sound of [koloła] (*kolohla*), a response of [ko] was given. In one respect, the answer is correct because the first sound was selected (/k/ is there in the response and the task is completed), but it is also incorrect because the response contains more than just the first phoneme; in effect it is one syllable and therefore the incorrect linguistic unit. This type of error is quite common and may shed light on which participants are not sensitive to phonemes. This error, where a consonant phoneme is provided along with a vowel is because of how the articulation of phonemes in a word are influenced by the surrounding phonemes of the word (Adams 1990). For example, [kiː] (*key*) and [kʉː] (*coo*), where /k/ is realised as more palatal in *key* because of the following high front vowel. It is therefore difficult to articulate a consonant phoneme in isolation. This could be especially true for isiXhosa where CV syllables are quite frequency and consonants are not often separated from their vowels. It may be the case that only phonologically aware participants are able to use such an abstract notion as the phoneme. This error was coded as "u".

3.4.2.3.3 Incorrect responses

Completely incorrect responses were also further sub-categorised into more than one sound substituted, and task errors. As mentioned previously if more than one sound was substituted this was an error more incorrect than if only one sound was substituted. This was coded as "s". Responses were categorised as task errors if the incorrect unit was selected and the task was not completed correctly. For example in identifying the second phoneme of *turhoza* and the participant responded *za* the linguistic unit is incorrect (it should be a syllable) and the task was not completed correctly (the second phoneme was meant to be identified). Finally, some participants responded in such a way that they exhibited no understanding of the task. This was marked as an un-unrelated response coded as "b". For example, one participant responded with the repetition of syllables rote learned in class, in identification of the second phoneme of *tolega*, the participant responded "*ta-te-ti-to-tu*" which is clearly incorrect. Although, not technically incorrect, non-responses, where participants opted out of answering were marked as such by coding these non-responses as “n”.

Table 11, below, presents a summary of all the coding decisions relevant to the phonological awareness task.

Table 11: Summary of PA coding

Accuracy	Categorical Error Coding	Criterion	Model answer	Actual answer
1	none	completely correct/ matches model answer in linguistic unit and task	second syllable of *turhoza = rho*	*rho*
0	c	one consonant is substituted	*za-rhe-no*	*za-rhe-lo*
	v	one vowel is substituted	*d-o-p-i-k-e*	*d-o-p-i-k-o*
	w	influence of orthography where digraphs are spelled out	*gc-e-n-a*	*g-c-e-n-a*
	u	incorrect unit used	first phoneme of *kolohla = k*	*ko*
0	s	more than one sound substituted	*dopike*	*dupiko*
	t	task completed incorrectly	second syllable of *turhoza = rho*	*za*
	b	unrelated response	second phoneme of *tolega = o*	*ta-te-ti-to-tu*
	n	Avoidance behaviour (non-response and repetition of stimulus)	segment *foma*	no answer
?	none	a question not asked by the research assistant		unknown

3.4.2.3.4 Data Analysis

The data from the PA measure was analysed for accuracy, types and frequency of errors on each task, the effect of word length, the position of the unit in the word, and orthographic influence.

The scores for the accuracy coding (answers scored as correct (1) or incorrect (0)) were totalled and converted to a percentage correct score for each task. Results for the syllable and phoneme version of each task were combined to create Segmenting, Identification and Deletion Scores. The results of Identification and Deletion were bimodally distributed so the sample was split into two groups according to participants’ sensitivity to phonemes. This is addressed in more detail in §4.5.2.

An analysis of the error types was also conducted by tallying the number of each category of errors. Because the phonological substitution of consonants, vowels and more than two sounds were quite low these were totalled to provide a phonological substitution error score. Tallies of the non-responses and unrelated responses were also added for each task.

3.4.3 Reading assessment measures

The reading variables of interest in this study are reading fluency, accuracy and comprehension. Reading fluency was measured by an oral and silent reading task, the results of which were combined to create a composite Fluency score. Accuracy was determined by subtracting the errors made on the oral task from the total number of words read. Comprehension was measured by two tasks: one following the oral reading text, and one which followed the silent reading text, the results of which were used to create a composite Comprehension score.

These tasks rest on the assumption that participants' reading rates and accuracy are "effective proxies" for their actual reading ability (Kuhn *et al*. 2010: 242). For the reading measures in this study, the definition of fluency as simultaneous decoding and comprehension is used (Kuhn *et al*. 2010). Measures of connected text fluency are commonly used in international research, although they usually make use of standardized tests for that language. Unfortunately, standardized whole text reading measures are not available for isiXhosa. Another common task used as a proxy measure of overall reading ability is word reading, where participants are required to read a list of words out loud that range in their frequency in the language. These tests are also usually standardized. Unfortunately, no standardized word reading lists exist in isiXhosa either and creating one is beyond the scope of this study.

This section discusses the development of the oral and silent reading tasks as well as the comprehension measures which followed them.

3.4.3.1 Oral Reading Fluency Measure

Oral reading fluency was measured with a one minute text reading task, after which 5 comprehension questions were asked.

Based on a review of the research about reading fluency, Kuhn *et al*. (2010) make recommendations for assessing reading fluency. Firstly, the fluency assessment should not only assess the number of words correct per minute, but also comprehension of the passage, so that there is not an overemphasis on speed. Rasinski (2004: 47) also suggests a measure of prosody, that measures the "expression, volume, phrasing, smoothness and pace" of reading.

The oral reading measure developed for this study takes these recommendations into account. So that the focus will be on naturalistic reading speed rather than accelerated speed, participants were asked to read in their best voice to elicit a naturalistic speed of reading from participants. Task instructions are presented in Appendix E. Comprehension questions were also asked after the reading of the passage. It was intended to include a measure of prosody. However, participants generally did not read very well and those that could did not generally use varying prosody. That is to say, most participants read the text syllable by syllable without using intonation which conveys understanding of the passage. For this reason, a measure of prosody was not included.

The text was chosen from a reading supplement in the Sunday Times aimed at Grade 3 isiXhosa readers. iSikitshana somLingo is a fictional text (Appendix F) (Hartmann n.d.). This text is titled The Magic Boat and is about a woman who lives on an island in a river. When the village people are starving she brings them fish, but never eats with them, even when asked. The king of the village becomes jealous and follows her back to her island. The text, in isiXhosa, was re-printed into larger text and displayed on a single A4 board. Story pictures were not included to prevent participants from guessing the story. Two words were changed from the original story to make it more contextually appropriate. A more frequent word for "boat" in the title was used. The name of the river, the Zambezi, was also changed to the Kei river because it is a large river in the area where the participants live. The text consists of 110 orthographic words, with 14 sentences with an average of 7.9 words per sentence. Words are on average 6.9 letters long.

Participants were instructed to read as best they could, starting from the title, while also paying attention to what they read. Participants were given one minute to read the text and were also recorded so that scores could be checked later. The one minute requirement stems from the fluency measurement method used in Curriculum-Based Assessment for which Hasbrouck and Tindal (2006) report norms for English reading at Grade 1 to 8 level. Asking participants to read for a set amount of time rather than completing the entire passage also ensured that time restrictions were adhered to. The last word read within the time limit by the participant was recorded on the score sheet by the research assistant during the task. The participant was then asked 5 comprehension questions which required an oral response. See Table 12 below for the full list of questions. The majority of the comprehension questions could be answered by reading the first three sentences of the story, including the title. Some of the questions required the child to use their own experience and the answers to these questions were decided based on their suitability.

Table 12: Oral reading task comprehension questions

Question Type	English Question	IsiXhosa Question	Expected Answer
factual	Where does the woman live?	Lalihlala phi eli xhegwazana?	On an island/ near the river
inferential	How do you think she travels to the village?	Lalisiya njani kwilali ekufutshane nalo?	By boat
factual	What did she bring the village people when they were starving?	Lalibaphathela ntoni abantu bale lali xa belamba?	fish
factual	What did the village people do when she brought them the fish?	Babesenza ntoni ababantu lakubapha iintlanzi?	They thanked her/ they asked her to eat with them/ they ate the fish
inferential	Why do you think she did not eat with the village people?	Kutheni ucinga ukuba laliye lingatyi naba bantu bale lali?	*Any suitable response that follows from the story*

The score sheets were checked by listening to the recording in order to minimize human and measurement errors, such as not recording an error or imprecise timing, respectively (Hasbrouck &Tindal 2006). The number of orthographic words read in one minute as well as the errors (words read incorrectly) were recorded on the score sheet. The number of errors was subtracted from the total words read to give an orthographic words correct per minute (wcpm) score which was used in later analysis. The answers to the comprehension questions were also recorded and marked as correct or incorrect.

The reading of a word was marked as an error if: the word could not be read and had to be supplied by the research assistant, if a word was mispronounced (*nelinobubele* as *nelino**d**ubele*), if syllables were added or omitted (*si* omitted from *elisisilumko* and read as *eli_silumko*), or if the word was omitted by the participant. All these cases, except for syllable addition and omission, are conventionally marked as errors in a standardized one minute oral reading fluency task (Shin *et al*. 1992). Cases where syllables are added or omitted were included as errors specifically for isiXhosa reading.

In order to avoid a one-dimensional view of reading ability, fluency should be considered as part of a larger set of tests (Kuhn *et al*. 2010). Considering the time constraints, it was decided to include a quick to administer one-minute silent reading test, which is reported in the following section.

3.4.3.2 Silent Reading Fluency Measure

The silent reading test took the same format as the oral reading text except participants were instructed to read silently; the direct translation from isiXhosa is “from inside”. See Appendix G for the silent reading task instructions. The text, titled Linkonde Ziyankqonkqoza, (the men who went knocking), was about three men who came into the village very early in the morning and knocked on one family’s door (Appendix H) (Bester n.d.). The text consists of 115 orthographic words, with 13 sentences with an average of 8.8 words per sentence. Words are on average 6.7 letters long. The text to be read silently has on average one more word per sentence than the orally read text, but the number of letters per word is comparable. This means that the silent version may have slightly more complex syntax because of the longer sentences, but word length is similar.

Participants were instructed to read silently until asked to stop. They were also instructed to use their finger to show which word they were reading while the research assistant watched them. With this method, a more accurate measure of the participant’s silent reading ability was measured. The biggest criticism of silent reading measures is participants’ inaccuracies in recording the last word they have read (Fuchs *et al*. 2001). However, instructing participants to read the words with their finger pointing to which word they are reading while the administrator watches has decreased the likelihood of inaccuracies in the self-reported number of words read. The individual assessment format coupled with the use of the finger to show which word is being read, increased the accuracy of the measure. Participants were asked to read for one minute and the last word read in the time limit was recorded on the score sheet. Participants were then asked 5 comprehension questions (Table 13) which were all factual. The comprehension questions were answered orally. The task was recorded so that the answers to the comprehension questions could be later transcribed, and to ensure that the task had been administered correctly.

Afterwards, the recordings were listened to and the comprehension questions recorded and marked as correct or incorrect. The final word read indicated on the score sheet could not be double-checked for accuracy because only audio recordings were made. The total number of words attempted for silent reading was recorded as well as the score for comprehension out of 5. No reading errors could be recorded for this task since the reading was done silently. The total number of words read in a minute and the percentage of comprehension questions answered correctly were used for later analysis.

Table 13: Silent reading task comprehension questions

Question Type	English Question	IsiXhosa Question	Expected Answer
factual	What time of the day was it in the beginning of the story?	Yayileliphi ixesha lemini ekuqaleni kwebali?	Early in the morning
factual	How many people were walking to the village?	Babebangaphi abantu ababesiya elalini?	Three people
factual	What did the men do when they came to the house?	Aye enza ntoni lamadoda akufika endlwini?	They knocked on the door
factual	What was mother doing while the children chatted and sang?	Wayesenza ntoni umama ngeli lixa abantwana bencokola bekwacula?	She was cooking
factual	Who knocked on the door?	Ngubani owaye wankqonkqoza emnyango?	The three men

3.4.3.3 Analysis

The number of words read correctly on the oral reading task and the number of words read in the silent task were averaged for each participant to create a composite Fluency score. The Accuracy score was the percentage of words read correctly in the oral reading task. The results of the two comprehension tasks were averaged to give a composite Comprehension score.

3.4.4 Spelling

A nonword spelling test of 15 words was developed for the study (Table 14). The nonwords spelling test measured participants' phoneme-grapheme correspondences. Since stimuli were nonwords, participants could not rely on their knowledge to spell the words, but must access their orthographic representation of the sounds. The nonwords used in the spelling test were taken from the stimuli list of the PA task. Almost half the responses contained only single consonants, and the remainder contained orthographically complex consonants. The spelling test was only administered in March of 2015, when the participants had reached Grade 4. Because of constraints regarding access to the schools and participants, the spelling test was only administered to 14 of the 52 participants.

The spelling test was administered in a group setting in a classroom at two of the schools. Participants were instructed to write their names and answers on the answer sheet (Appendix I). The first language isiXhosa research assistant explained that she was going to say some words and the participants had to write them down as they sounded. Participants were instructed to attempt every answer, even if they were not sure of how to spell the word. The research assistant said each stimulus three times; with about a 5 second pause between repetitions. She also moved around the room to ensure that all participants heard the stimulus clearly.

Table 14: Nonwords used in spelling test

Orthographically simple nonwords	Orthographically complex nonwords
1. Tuza	8. Samatse
2. Qetaza	9. Tyizena
3. Vamala	10. Turhoza
4. Gefina	11. Kolohla
5. Dopike	12. Hlama
6. Bocena	13. Gcena
7. Mekuma	14. Dlashaza
	15. Tshafiba

At the end of the test, the answer sheets were taken in and scored. Answers were marked as correct if they were written exactly how the research assistant had said them. Errors were marked as incorrect.

3.5 Procedures

3.5.1 Sampling Procedure

The school principals of the three schools which are part of the Sandisa Imbewu Literacy Project were contacted to ask permission to perform the study. All three principals agreed and then asked the relevant teachers at the school who also agreed to participate in the study. Consent forms for parents were given to all learners in the Grade 3 classes. Only those learners who returned consent forms and were present at school on testing days were eligible to participate in this study. Participants were instructed that they were allowed to discontinue participation in the study at any time without any repercussions.

3.5.2 Procedure for the selection and training of research assistants

Because I am not a first language speaker of isiXhosa I required the help of research assistants. A request for research assistants was put out via email to all Linguistics students (undergraduates and postgraduates), as well as on the Rhodes University Student Representative Council Facebook page. The request asked for first language speakers of isiXhosa who were interested in the research. Remuneration was stated as an incentive on the advert.

Fifteen people responded to the advert. In conjunction with the other researchers on this project, it was decided to only interview students who were in second year or above, because first year students typically have a high course load and would not be able to commit to the long hours of testing out of Grahamstown. The remaining 8 respondents were asked to come to an initial interview to establish their language background and commitment to the job. All 8 respondents were asked to be research assistants on the project because their language backgrounds were adequate for the job. Six of these respondents were undergraduate students at Rhodes University from different faculties, one respondent was a postgraduate student, and one was a member of Rhodes academic staff.

A testing booklet was compiled for the assistants. This instructional booklet contained the tests and instructions for all the tasks which were part of the project. The assistants attended a 2 hour training session to go through this testing booklet. The relevant researchers explained their projects and tasks and coached the assistants through administration. Assistants then chose which task they would like to administer and learned how to do this correctly and consistently. In addition to this, in transit to the venues, assistants were given opportunity to practice administering the tasks with the relevant researchers. Finally, assistants were given feedback after each session about where they could improve or be more consistent. Assistants also signed an agreement to keep all knowledge of participants and research materials confidential.

3.5.3 Testing Procedure

Testing took place in the third and fourth term of the school year in the months of August, September and October of 2014. The subsample of participants who did the spelling test were tested in March 2015. Testing took place in a room available at each school. In the case of schools 2 and 3, this was the staff room, and in school 1 the vice-principal's office was made available.

This research forms part of a larger project funded by the Sandisa Imbewu Literacy Project which examines reading in South African Bantu languages. The original sample of 91 participants also took part in two other related studies along with this study. One study examines morphological awareness in isiXhosa and the other examines reading strategies in isiXhosa. Testing was therefore split into two sessions of 30 minutes at each school to avoid fatigue effects (Abbhul *et al*. 2013). The second session took place at least the day after the first session to at most a week after the first session. However, different concepts were tested in each session so there would be no effect of time between sessions on performance. Table 15 presents what tasks were completed in each session. Test stations marked with an asterisk are those tasks reported in this study.

Table 15: Testing Procedure

Session 1		Session 2	
*** Test Station 1**	Oral Reading Task Silent Reading Task Rapid Naming Task	*** Test Station 1**	Syllable Awareness Task: - segmenting, - identification - deletion
Test Station 2	Decomposition Task	*** Test Station 2**	Phoneme Awareness Task: - segmenting, - identification - deletion
Test Station 3	Morphological Awareness: - oral 'wugs' test - written morpheme-identification task	**Test Station 3**	Morphological Awareness Task: - oral analogy task - written word-building

The decomposition task in session one forms part of the study examining reading strategies in isiXhosa. The decomposition task requires the child to read 20 sentences and indicate with a whiteboard marker how s/he "broke up" the sentence to read it. This was an open ended task which sought to examine the extent to which learners use the syllable or morpheme as a way to parse sentences. See Probert (2015) for a more detailed explanation of this task. The morphological awareness tasks in test station 3 for each session form part of the study which examines morphological awareness in isiXhosa. The tasks examined inflectional and derivational morphology in oral and text-based formats. See Rees (2016) for a more detailed explanation of this task.

There were three test 'stations' in each session, with three children participating in a session at a time, one child at each station. Participants did tasks individually with one first language isiXhosa research assistant who administered the task at each testing station. Tasks were assigned to sessions with a consideration of potential carry over effects from order of presentation (Abbhul *et al*. 2013). Thus, all tasks in session one required reading to some extent and were quite similar to tasks done in school and tasks in session 2 were unrelated to tasks completed in school.

In Session 1 at testing station 1, the oral and silent reading tasks preceded the rapid naming task. It was necessary for the RAN task to be administered last because its focus is on the speed of naming, whereas the reading tasks should elicit a naturalistic reading speed rather than speeded reading at the expense of comprehension. The decomposition task and morphological awareness tasks are unrelated to RAN or either reading task. For test session 2, the phonological awareness tasks were split up because of time constraints. Thus, participants performed all the syllable tasks at one station and then the phoneme tasks at another station. Every effort was made to counterbalance participants for order of presentation of the PA tasks as explained in section 3.4.2.1.2. Of the 52 participants reported on in this study 23 participants (44%) were administered the syllable tasks first and 29 participants (56%) were administered the phoneme tasks first.

Participants were given a name badge which had their name and their participant code (to ensure confidentiality) and were sent to a testing session. Only the participant code was recorded on score sheets. Upon completion of the task, learners were sent to the next test station until they had completed all three stations. Learners were given a sticker as a reward after each task. If children finished the task early they were allowed to color in pictures at a different table. All children received a picture to take with them once they had finished the session. All tasks and explanations of the task were in isiXhosa and administered by an L1 isiXhosa speaker.

In order to promote responsible research and meaningful interaction (Eckert 2013) with the schools where this study took place, a feedback session for each school will be organized on completion of the project. This feedback session will take the format of a presentation where the research will be disseminated to the teachers and other interested parties at the schools. This will ensure transparency in the research process and allows the school body to benefit from the research in that they may be able to apply the findings. It is always important to be explicit in what services can and cannot be offered by the researcher on completion of a study (Eckert 2013). In discussion with the school principals and teachers it is the intention that some pedagogic materials can be developed based on the findings of the study.

3.5.4 Exclusion Procedure

There was a need to exclude some participants from the study. Because the goal of this research is to examine the relationships between phonological awareness and different reading abilities, it was necessary to omit certain participants who had missing data points, or who did not complete the tasks correctly, presented in Table 16, below. A visual representation of the number of participants excluded is presented in Figure 5.

With reference to missing data, those participants who were missing more than one data point were excluded first. The spelling task was not considered here since a very small subset of participants were administered this task. Incomplete data sets (with more than one data point missing) resulted when some tasks (or parts of them), through human error, were not administered, were administered incorrectly, or were administered but not recorded so that no checks could be performed on the quality of the administration. Participants who were absent from one of the testing days, and therefore only had been administered half the tests, were also excluded. Sixteen participants were excluded on these criteria. The reason for this exclusion is that many missing data points may affect the reliability of the conclusions drawn about the relationship between the independent variables and reading.

Table 16: Exclusion Procedure

	Exclusion Criterion	Explanation	Number of excluded participants	Remaining Sample Size
Step 1	More than one data point missing	- Participant absent on test day - Errors in administering the task	16	77
Step 2	Lack of automaticity in the RAN task	- Finger counting - Misidentifying digits - Digits not named in isiXhosa even when asked - Lack of knowledge of isiXhosa number name	12	65
Step 3	Data point missing	- Missing data point for one of the 6 PA subtasks	13	52

In order to retain the integrity of the data, participants' scores on the RAN task were re-assessed. Participants who did not perform the RAN task adequately were excluded. The naming of 9 digits before the RAN task served as a control to determine which participants could not **automatically** recall digits in **isiXhosa**. Since the test relies on automaticity or relative speed of recognition, those participants who could not automatically name the practice digits were excluded from later analysis. The lack of automatic recall was identified when participants: counted from one to get to the name of each digit, named the digits incorrectly (e.g. named 7 as 8), said the digits in English and could not say them in isiXhosa even when asked to and simply not knowing the number name at all. A further 12 participants were excluded on these criteria.

The application of these exclusion criteria resulted in a remaining sample of 65 participants. However, even after the two prior steps were implemented, some participants were still missing one data point for a subtask in the syllable or phoneme awareness tasks i.e. 1/6 data points were missing for the phonological awareness task. A further 13 participants were excluded because they were missing data for one of the PA tasks after the other exclusions were applied.

To examine spelling, only the data from the 14 participants who were administered the spelling task were used.

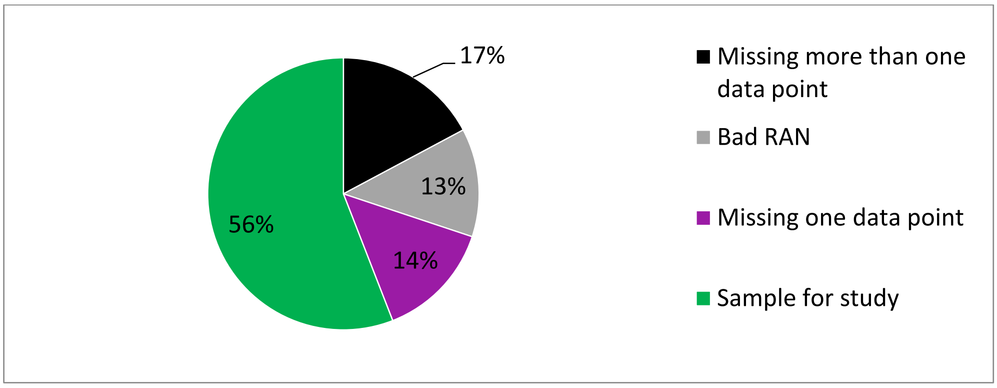


Figure 5: Ratio of excluded participants

It is important to remark here on the nature of the missing data. Rubin (1976) explains that missing data is unproblematic if it is missing completely at random i.e. there was no reason why that participant did not perform that task. However, if certain data are missing because of some reason, or that a task is not administered for a reason, such as the child being a bad reader, then this type of 'missingness' is problematic (Howell 2008). Examination of the missing data in this study reveals that the data are missing at random. Participants were not singled out and then purposefully excluded from completing certain tasks. Rather, data is missing, as explained earlier in this section, because of factors outside of the control of the researcher such as absenteeism. For this reason, missing data is not problematic in this study. However, the strictest sample size which includes participants who have data for every task is used in this study because the statistical analysis requires a data point for every instance.

The number of participants that were excluded is quite large (almost half the original 93 participant sample). This was mostly due to the complicated testing situation where data from three studies was being collected at a single time by a number of researchers. Unfortunately, this situation could not be avoided. However, the remaining sample of 52 participants is adequate. In other similar studies, the results of samples of 60 (Moll *et al.* 2014), and 50 (Wilsenach 2013) participants have been used in regression analysis. This thesis is a first look at PA and NS in isiXhosa, and the intention is that the trends noted here should be explored in larger samples, with improvements made on the existing methodology.

3.6 Data Analysis

As mentioned in the previous sections, composite scores were created for the PA tasks by averaging the responses for syllables and phonemes to give composite Segmenting, Identification and Deletion scores. Only the Deletion score was used in later analyses, as is common in other studies. The Items per Second score is used as a measure of naming speed. The Words Correct per Minute score from the oral reading task, and the Number of Words read in the silent reading task was averaged to give a Fluency score. The percentage of correctly read words on the oral reading task was used as the Accuracy score. Finally, the comprehension scores were averaged to give a composite Comprehension score.

The data for all measures were analysed for normality. Only Identification and Deletion were not normally distributed. They presented bimodal distributions, which indicated that some participants did not have the ability to perform these tasks. The bimodal distribution in the Deletion score was overcome by splitting participants into two smaller samples according to the types of unit errors they made on the Deletion tasks. This is addressed in detail in §4.5.3.

The splitting of the sample into two smaller groups improved the normality of the PA data and did not affect normality in the other variables. These two sub-samples were analysed separately. Forward stepwise regressions were run separately for each subsample and the larger sample to determine the roles of phonological awareness (as measured by deletion) and naming speed to reading fluency, accuracy, comprehension and spelling.

4 RESULTS AND DISCUSSION

4.1 Introduction

This study explores the importance of phonological awareness and naming speed to different reading abilities in isiXhosa. The tasks were created for use in this study because standardized versions are unavailable for isiXhosa.

§4.2 of this chapter presents the descriptive statistics for each task used in this study, describing the distribution of and relationship among the independent and dependent variables for the whole sample of 52 Grade 3 participants. Analysis of the distributional data provides insight into the suitability of the tasks. This leads into a detailed analysis of the results from the PA measure in §4.5 which includes the factors which influence PA as well as an analysis of the types of errors made on the tasks. This informs Research Question 1. A good understanding of the PA levels of readers is essential to understanding reading development (Ziegler & Goswami 2005). The findings confirm that the tasks used in this study are well-designed.

The analysis of the PA data revealed an interesting bimodal distribution in the Deletion scores. Use of this data would violate the assumptions of normality of the multiple regression run to answer Research Question 3. Therefore, the non-normal distribution was overcome by splitting the participants into two groups according to the types of errors made on the Deletion task, ultimately splitting participants into those with high levels of PA and those with low levels (addressed in §4.5.3.3). At the same time, these groups showed differing levels of naming speed but did not differ in their reading abilities (addressed in §4.6). The remainder of this chapter therefore reports on the data for the whole sample and the two sub-samples.

A correlational analysis, reported in §4.7, was run to determine whether PA and NS share variance, as well as to determine their individual relationships with the reading variables, informing Research Question 2. This analysis showed that the independent variables were moderately related so that multicollinearity in the multiple regression would not be problematic. §4.8 reports on the results of the multiple regression and addresses Research Question 3.

The results of the regression, run for the whole sample and both sub-samples, reveals that the contributions of PA and NS are greatest for the group with lower levels of PA and NS, and their role is attenuated in the whole (unselected) sample and the sub-sample with higher levels of both

PA and NS. The results confirm the trends outlined in Chapter 2: PA is important for reading accuracy and comprehension. Interestingly, both PA and NS account for variance in reading fluency in isiXhosa. These findings are interpreted in light of the PGST and the theory covered in Chapter 2.

4.2 Descriptive statistics

Table 17 presents the descriptive statistics for each measure used in this study. This section addresses what the distribution of the data shows about the construct being measured and the suitability of the developed tasks. The dependent reading variables are then addressed (§4.3), followed by the results of the RAN task (§4.4). The results of the phonological awareness task are addressed last (§4.5) because they are examined in the most detail, thereby answering Research Question 1 which focuses on the characteristics of phonological awareness in isiXhosa.

As described in Chapter 3, learners (N = 52) are all first language isiXhosa speakers and are all instructed in isiXhosa in Grade 3 at school. Participants from three schools were tested. Almost half the sample are male (N = 24).

Table 17. Descriptive statistics for all tasks and composite scores

Variable/Task	**Mean** (*N*=52)	**(*SD*)**	**Min**	**Max**
Age[a]	**10;8**	**(1)**	**8;9**	**12;10**
Phonological Awareness Task[b]				
Segmenting[b]	**53.0**	**(11.2)**	**30**	**80**
Syllables[b]	*87.4*	*(16.8)*	*0*	*100*
Phonemes[b]	*18.6*	*(17.2)*	*0*	*60*
Identification[b]	**56**	**(24.9)**	**15**	**95**
Syllables[b]	*66.7*	*(30.5)*	*0*	*100*
Phonemes[b]	*45.2*	*(35.1)*	*0*	*100*
Deletion[b]	**46.5**	**(29.5)**	**0**	**95**
Syllables[b]	*51.9*	*(28.5)*	*0*	*100*
Phonemes[b]	*41*	*(36.3)*	*0*	*100*
Rapid Automatized Naming of Digits[c]	0.76	(0.34)	0.20	1.67
Oral Reading Fluency Task				
Words attempted in one minute[d]	21	(12)	0	46
Words correct per minute[d]	19.4	(12.8)	0	46
Accuracy[b]	**77.7**	**(34.3)**	**0**	**100**
ORF Comprehension[b]	23.8	(26.9)	0	100
Silent Reading Task				
Words attempted in one minute[d]	27.3	(15.5)	0	63
SRF Comprehension[b]	42.3	(29.3)	0	100
Composite Fluency Score[d]	**23.3**	**(25.3)**	**0**	**53.5**
Composite Comprehension Score[b]	**33**	**(13.8)**	**0**	**90**

Units: [a]years, [b]percentage, [c]items per second, [d]words in one minute

4.3 Text reading and comprehension tasks

4.3.1 Oral Reading Fluency

Participants' ability to read the text out loud varied, with some participants unable to read a single word and some being able to read 46 words in the allotted minute. The mean words read aloud was 21 words (*SD* = 12.0). The data were normally distributed (*K-S d* = 0.11, $p > .05$). Of course, the inability of some participants to read a single word is quite alarming considering that participants have been in formal schooling for almost three years. Participants were also not always accurate in their reading. The total number of errors was subtracted from the total number of words read to produce a WCPM score. The WCPM score ranged between 0 and 46, with a mean WCPM score of 19.4 (*SD* = 12.8). This distribution was also normal (*K-S d* = 0.10, $p > .05$). The WCPM and Words Attempted are almost perfectly correlated ($r = .99$, $p < .001$), so only the WCPM score is used as the measure of oral reading fluency because it takes errors into account.

4.3.2 Oral Reading Accuracy

The accuracy with which participants read out loud is the total WCPM as a percentage of Words Attempted. The mean accuracy score was 77.7% (*SD* = 34.3) indicating that a large proportion of participants achieved high levels of accuracy, but that some did not (minimum 0%; maximum 100% accuracy). In fact, 34 participants (65% of the sample) were reading at ceiling levels between 90 and 100% accuracy. The accuracy data are therefore not normally distributed (*K-S d* = 0.32, $p < .01$) because of the long left tail. Data transformations did not improve the normality of the data so the raw score was used in later analyses.

This high level of accuracy is to be expected since isiXhosa is written relatively transparently. In a transparent orthography, readers reach high levels of accuracy by the first year of reading instruction (Seymour *et al*. 2003); the learners in the current sample are in the later months of Grade 3 and high levels of accuracy should be expected. Research also shows that even reading disabled children of transparent orthographies attain high levels of accuracy, but it is their reading speed which is the mark of a reading disability (Wolf & Bowers 1999, Aro 2004). However, Figure 6 shows that inaccurate readers in this sample are also slower readers (indicated in the oval on Figure 6) and that some learners, although they have higher levels of fluency, are not highly accurate given that they read below 90% accuracy. The Total Words Attempted is used as the dependent measure to highlight cases where errors are due to speeded reading.

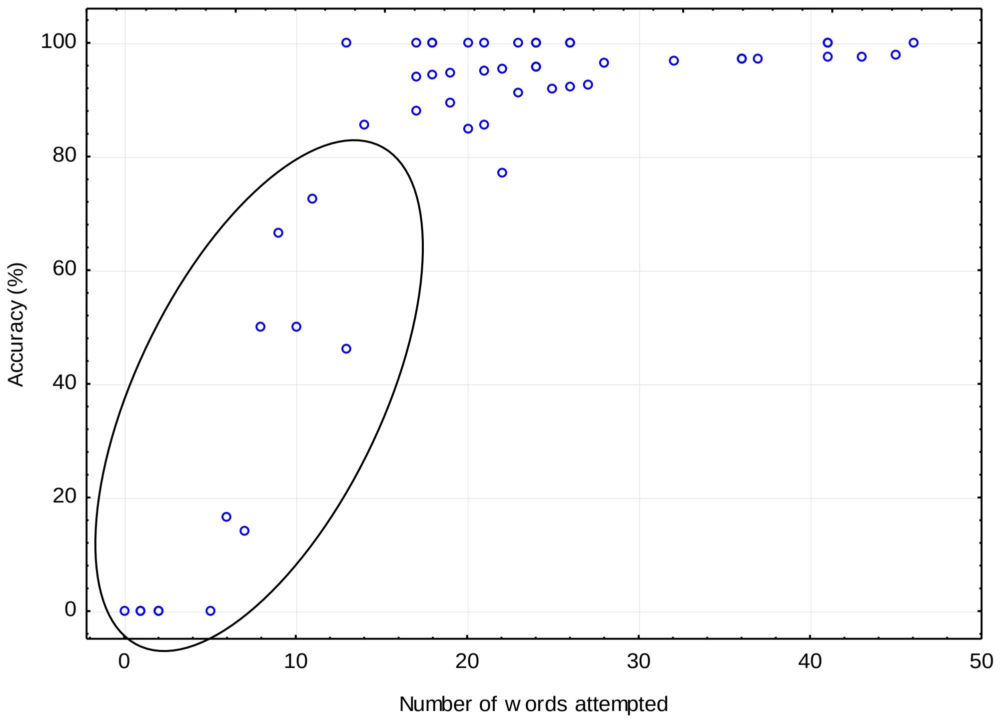


Figure 6. Relationship between number of words attempted and accuracy of oral reading

Of interest then, is why there are a number of participants with low(er) levels of accuracy, when isiXhosa is written transparently. There are a number of possible reasons or interpretations which are not necessarily mutually exclusive:

(1) the oral nature of the task

(2) there were other external factors that affected performance (such as being distracted) at the time the task was administered,

(3) there is an accuracy-speed trade-off (as speed increases, accuracy decreases and vice versa), and/or

(4) perhaps that these specific learners (indicated in the oval) may have a reading disorder.

The scope of the study is unfortunately too narrow to answer these questions definitively, but further analysis may shed some light on the highlighted concerns. The concern in the first point highlights that the errors in reading may be induced because of the oral nature of the task. That is, perhaps participants made slips of the tongue errors, which did not affect their comprehension (the goal of reading), but was marked as an error. This is not likely to account for the errors seen on the task since errors that were self-corrected were not marked as errors on the score sheet. This means that when participants made errors while reading they did not realise that they had done so and did not self-correct. This concern is addressed by creating a composite reading fluency score which takes into account both silent and oral reading. In this way, the effects of the oral nature of the task can be attenuated.

With reference to concern number 2, it is acknowledged that with even the most controlled experimental study there will always be 'noise' or external factors which can affect performance on the measures. Every attempt was made to limit the effect of 'noise' on the tasks, but this was not always practically possible. Tasks were administered in the only available room in the school, the staff room, and there were therefore occasional interruptions. If, however, external factors really did play a large role in affecting the accuracy scores, then there should not be a strong relationship between reading ability and accuracy. Rather the relationship between accuracy and fluency should be low because achievement was influenced by external variables. The strength of the relationship between the variables would also address concern number 3, which asks if there is an accuracy-speed trade-off.

The Spearman rank order correlation coefficient between accuracy and speed suggests that indeed, external factors may not have played a monumental role, because there is definitely a strong positive monotonic trend to indicate an accuracy-speed relationship ($r_{(s)} = .76$, $t = 8.34$, $p < .001$). This is presented visually in Figure 6, above. This finding actually is in opposition to what is considered the "accuracy-speed trade-off". The accuracy-speed trade-off is the result when readers read too fast, accuracy decreases, and readers seeking to improve their accuracy may read slower. What is found in the data in my study is that speed and accuracy increase together. A similar finding is reported for Finnish dyslexic readers (Leinonen *et al*. 2001), where the most successful readers were those who favoured speeded text reading over more accurate, but slower reading. Readers could overcome poor phonological decoding skills by reading text faster and using their lexical knowledge. This finding then suggests that perhaps both naming speed (theorised to be linked to reading speed) and phonological awareness (theorised to be linked to reading accuracy) are both important for reading in isiXhosa.

The trend that accuracy and fluency increase together then may also address the last question, that maybe some readers in this sample have reading disabilities. The results of the multiple regression, reported on in §4.8 may support this idea, as well as evidence from Figure 6 which identifies a group of readers (circled) who are both slower readers (as compared to their peers), and less accurate. In fact, analysis of the phonological awareness data shows that there are two groups in this sample, those who can perform phonological awareness tasks, and those who cannot. A detailed analysis is provided in §4.5.

4.3.3 Comprehension (following oral reading) results

After the oral reading task, participants were asked five comprehension questions which followed on from the text they had just read. These 5 questions were used as a measure of general comprehension ability. The mean score was 23.9% (*SD* = 27), with a minimum of 0 and a maximum of 100%. The data were therefore positively skewed. This is a general low level of comprehension ability as determined by this measure, probably because of the low levels of achievement in reading fluency. Low levels of comprehension have been reported before for Setswana readers (Malda *et al*. 2014). Malda *et al*. 2014 argued that this was because readers in her sample were still becoming automatic in decoding, which makes it more difficult to comprehend what was read. This explanation could also be considered for the sample of the current study.

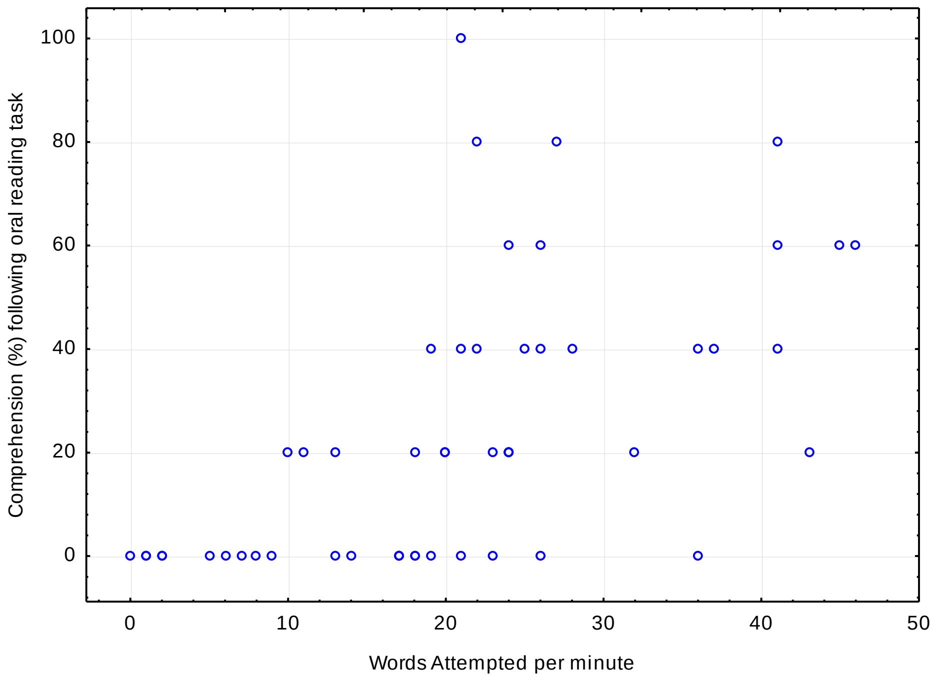


Figure 7. Words attempted and Comprehension following oral reading task

Another interpretation of the low level of comprehension could be due to task requirements: that if fewer words are read in the reading part of the task, automatically less can be understood because the participants did not get far in the text. That is to say, if participants read or attempted to read few words in the text reading task, then they are more likely to perform poorly on the comprehension measure. If this is the case, then there should be a strong positive correlation between Words Attempted and this Comprehension measure. The non-parametric Spearman rank order correlation coefficient is indeed, moderate-to-strong and positive indicating that scores in comprehension do increase as the number of words read increases ($r_{(s)}$ = .69, t = 5.73, p < .001). Figure 7 presents this relationship in a scatter plot and shows that although the two scores increase in a positive relationship, this is not necessarily a linear relationship, and some participants although reading many words, score 0% on the comprehension task.

Complicating the matter is that research shows that readers who are more fluent generally have higher levels of comprehension (Fuchs *et al*. 2001). Therefore the finding that there is a positive relationship between Comprehension and Words Attempted may not only be a consequence of the fact that the Comprehension questions were based on the oral reading task. The 5 questions asked after both text reading tasks are assumed to be a measure of general comprehension ability. Thus, a second interpretation of the task is that the 5 questions asked do indeed reveal the general comprehension ability of the participants, rather than being influenced by the number of words read in the previous reading task. In this case, the two comprehension measures should have a strong positive relationship, and they do ($r_{(s)}$ = .60, t = 5.29, p < .001) (see Table 18).

Table 18. Spearman correlations among reading variables

	Words Attempted (oral)	Comprehension (oral text)	Words Attempted (silent)
Words Attempted (oral)	-		
Comprehension (oral text)	.68***	-	
Words Attempted (silent)	.87***	.59***	-
Comprehension (silent text)	.57***	.60***	.58***

***p<.001

Furthermore, if the comprehension task measures participants' general comprehension ability, the comprehension tasks should have similar relationships with both the oral and silent versions of the reading fluency tasks. The data (Table 18) show that the comprehension task following the silent condition has a similar relationship to the fluency score for both oral and silent text reading ($r_{(s)}$ = .57 and .58 respectively, p < .001). However, the comprehension following the oral condition has a stronger relationship with the oral text reading fluency ($r_{(s)}$ = .68, p < .001) than with the number of words read in the silent fluency task ($r_{(s)}$ = .59, p < .001), but both are still moderate in strength.

Thus, it seems that the fact that the comprehension task was related to the previous reading task, may have influenced the comprehension scores and there is a need to measure the construct of general reading comprehension using a task separate from the reading task. However, since the two comprehension scores used in my study are moderately correlated, they adequately measure the participants' general reading comprehension ability.

4.3.4 Silent reading task

The silent reading task followed the same format as the oral reading task. Both tasks rest on the assumption that reading a text for one minute is a good proxy for overall reading ability (van den Boer *et al*. 2014). The silent version of the task was used to overcome critiques of the previous task that an oral reading task cannot be used as an overall proxy for general reading, when general reading is done in a silent mode. Furthermore, the oral version of the task requires attention to phonological representations and articulation (Halladay 2012) which could affect the participant's reading. In this study, this assumption that oral reading can act as an adequate measure of overall reading ability can therefore be evaluated. At the same time, a more representative measure of reading ability can be calculated by making a composite score of the two text reading measures.

As expected, participants read more words in the silent version of the reading task than the oral version. The mean number of words read (as indicated by the participants moving his/her finger as s/he read) was 27.3 words (*SD* = 15.5) with one participant reporting that s/he read 63 words in the allotted minute. A dependent t-test confirmed that participants were able to read more words in the silent mode ($t_{(51)}$ =8,04, p <.001). Again, however, there were some participants who could not read a single word in the silent condition, even without the pressure of oral reading.

Reading more words in the silent condition was to be expected because the silent condition involves fewer processes which may have resulted in them being able to read more (van den Boer *et al*. 2014). However there may also be other reasons for this finding. The text used in the silent reading task may have been easier than that used in the oral version. Lastly, there could be order of presentation effects, since participants had learned what was expected of them in the previous oral reading task, they may have been better prepared for the second, silent, task.

These explanations for the higher scores in the silent task are all valid. Nevertheless, with reference to order of presentation effects, all participants received the same order so at least all scores were affected uniformly. With reference to text complexity, there are currently no measures of text complexity in isiXhosa so the texts could not be compared objectively. However, both texts were taken from the same reading supplement which was aimed at readers of the same age. There was also a similar number of words per sentence (7.9 and 8.8 words per sentence for the oral and silent texts), and letters per word (6.9 vs 6.7). Finally, there is a very strong Pearson correlation between the two text reading scores (r = .89, p < .001), but the coefficient of determination stands at 79%. This means that although the two text reading tasks are clearly measuring the same construct (overall reading ability); there remains 21% unexplained variance. This unexplained variance could be due to factors such as activation of phonological representations, text difficulty, and order of presentation effects. It is therefore noted, that although there are many suggestions for improvement, the current measures of text reading both measure general reading ability, although the demands of the oral task mean that participants read fewer words.

The trend that participants scored better on the silent task may have implications for reading research where an oral reading task is used as a measure of general reading ability. This study shows that the results of a silent and oral reading task are significantly different from each other and, if using a related comprehension measure, the comprehension scores will reflect this. In the current study the influence of one mode of reading over the other is overcome by creating a composite reading fluency score by averaging the number of words read in each mode.

4.3.5 Comprehension (following silent reading) results

As with the oral task, 5 comprehension questions were asked after participants read the passage for a minute. The mean score was 42.3% (SD = 29.3%) with a minimum score of 0% and a maximum score of 100%. The comprehension results from the silent reading task were normally distributed (K-S d = 0.15, p > .05) unlike those answered from the oral task. Comprehension levels on the silent task were greater than the comprehension levels for the oral task, confirmed by a non-parametric Sign test (Z = 4,17, p < .001). On the one hand, participants could have performed better in the comprehension on the silent task because they had more attentional resources available, because they did not have to think about pronunciation. On the other hand, participants may have been primed to pay attention to certain aspects of the story because of the question from the previous task. Once again, at least the latter critique applies to all participants equally. The differences in the two comprehension tasks will even out as a composite score for comprehension was created. This resulted in a normal distribution which is used in later analyses.

4.3.6 Composite scores for reading fluency and comprehension

As already discussed, composite scores were created for the reading fluency and comprehension measures. This section summarises why the composite scores were created and makes recommendations for future research.

The creation of a composite score for reading fluency was motivated by the fact that reading in the real world tasks place in two modes, orally and silently, although most reading is done silently. However, the measurement of the different modes has its own downfalls that a composite measure seeks to overcome. For example, the oral version of the task allows for accurate assessment of speed of reading, but the added need for articulation may reduce the representativeness of this measure for overall reading ability. On the other hand, the silent version of the task most mimics the reading required in everyday life, but measurement may not be an accurate representation of the fluency of reading because it is a self-report measure. By combining these scores, the shortfalls of both modes are overcome.

In order to present a more representative score, the results of the two reading tasks were combined, and the results of the two comprehension measures were combined to create Fluency and Comprehension scores respectively. The composite score, as presented in Table 17, on page 94, for Fluency indicates a mean number of words read of 23.3 words (*SD* = 25.3). Skewness and kurtosis are within acceptable limits, and the data are statistically normally distributed (*K-S d* = .08, $p > .05$). The composite score for comprehension reveals an average of 33% (*SD* = 13.8%). Skewness and kurtosis are within acceptable limits, and the data are statistically normally distributed (*K-S d* = .12, $p > .05$).

In summary, a composite score for Fluency adequately overcomes the critiques of using only an oral or silent measure. The data show that the average number of words read in one minute is 23.3 orthographic words. Reading norms are not available for isiXhosa Grade 3 learners for comparison. Reading accuracy is generally quite high for those who read more than 10 words a minute, but slow readers are also quite inaccurate. Text comprehension levels are quite low (M = 33%) but this may reflect the type of task.

4.4 Rapid Automatized Naming Task

The rapid automatized naming speed task was presented after the two reading tasks, and was used as a measure of naming speed[8]. Participants were required to read the digits 2, 4, 6, 7, and 9 in an array of 5 across and 15 down for 15 seconds. The time required to name the numbers correctly in 15 seconds was recorded and the result was converted into an items correct per second score, which was used for later analysis.

Participants ranged in their scores from 0.20 items/second to 1.67 items/second (M = 0.76 SD = 0.34), presented in Figure 8. The data are statistically normally distributed (K-S d = 0.16, p < .05). No other data for isiXhosa Rapid Automatized Naming tasks is available for comparison unfortunately. Most participants name 0.67 items per second.

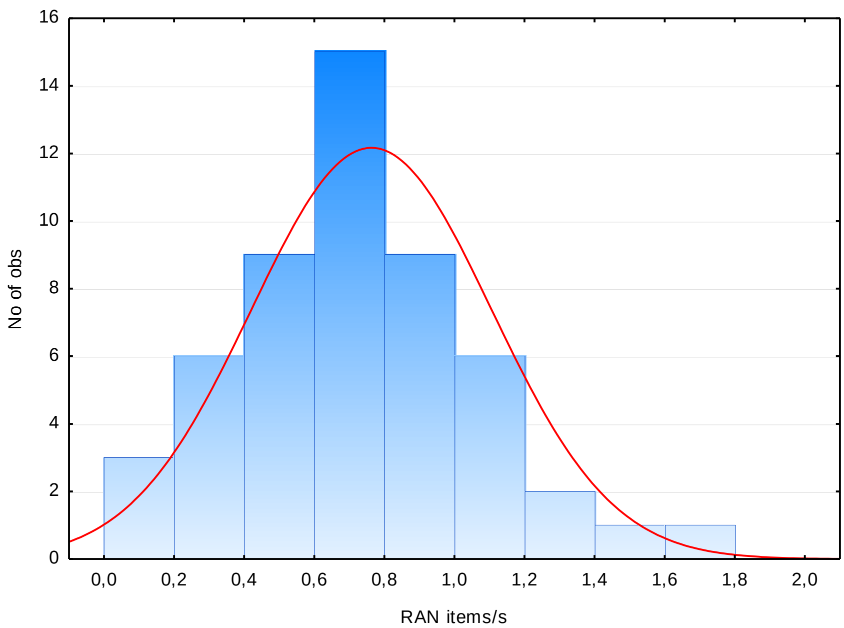


Figure 8. Distribution of RAN scores

Naming speed has a significant linear correlation with all dependent variables. Table 19 presents the results of a Pearson correlation. As established in the literature and reproduced in isiXhosa, NS has a positive relationship with reading fluency (r = .38, p = .006) and comprehension (r = .34, p = .01). Less reported in the literature is that NS also has a positive relationship with text-reading accuracy (Savage & Frederickson 2005). NS and oral text reading accuracy also have a positive relationship in isiXhosa (r = .44, p = .001). This can be explained with reference to

[8] Again it is acknowledged that the use of only one type of RAN task limits the strength of the conclusions that can be drawn. Nevertheless, trends in the relationship between digit naming speed and other variables can be identified and further explored in later studies.

Figure 6 on page 96 because of the link between reading speed and NS. IsiXhosa readers who read faster in the oral text reading passage were more likely to be accurate, perhaps because they rely on semantic or contextual cues to reading (Leinonen *et al*. 2001).

Table 19. Correlations between Naming Speed and dependent variables

	1.	2.	3.	4.
1. Naming Speed	-			
2. Fluency	0,38**	-		
3. Accuracy	0,44**	0,75***	-	
4. Comprehension	0,34*	0,62***	0,50***	-

*p <.05 **p <. 01 *** p<.001

Few errors were made on the RAN task. A total of 10 participants (or almost 20% of the sample) made one error only and the remainder of participants were completely accurate in their responses. The scores of participants who had made an error were adjusted so that only the correctly named digits were taken into account. Participants who made errors on the RAN task did not differ from the ‘no error’ RAN task group on any of the other variables in the study as shown by a one way ANOVA ($F(9, 42) = 1.03$, $p = .43$) . This suggests that the errors made by some participants were genuine slips of the tongue, or eyes (when a number was omitted), rather than an indication of lack of automatisation in digit naming. Recall that participants who did not know number names in isiXhosa were excluded from the study since the task required participants to provide the isiXhosa name. Use of the English label may give participants an exaggerated number of items per second since English number labels have fewer syllables and therefore take less time to pronounce.

Research is needed on the relationship of the RAN items per second score to isiXhosa reading when digits are named in another language such as English. It may be the case that participants are much more automatic in naming English numbers than isiXhosa numbers. The University of Fort Hare (1989) states that English numerals are used in schools to teach mathematics. It may have been ambitious then to expect all children to automatically name digits in isiXhosa. In fact, 12 participants of the original 93 participant sample were excluded because they either did not know the numbers in isiXhosa, or did know the numbers but could not recall them with sufficient automaticity. It would be expected that the speed of naming in one language should be similar to naming in the second language, provided both sets of number names are recalled automatically. However, the problem here is that isiXhosa and English number naming cannot be directly compared because of the large differences in number names. A future study could examine the naming abilities of readers who are automatic in both English and isiXhosa number naming and see how these two conditions relate to reading in either language. It can be expected that the naming latencies in both conditions would be highly correlated since the RAN task taps an underlying construct which should be the same in either language. More research is warranted in this area.

In summary, naming speed in isiXhosa is also related to fluency and comprehension, as well as oral reading accuracy. Future research could examine the relationship between naming in a second language (such as English) and reading in the first language. This may have the added benefit that children are more automatic in naming English numbers than isiXhosa numbers.

4.5 Phonological Awareness Task – answering research question 1

Phonological awareness, one of the independent variables, was measured using segmenting, identification and deletion tasks that targeted the syllable and phoneme. Tasks which targeted the same linguistic units were administered together. Almost half the participants were administered the syllable tasks first and almost half were administered the phonemes tasks first (Table 20). The range of tasks targeting each linguistic unit was employed in order to gather a large amount of information about the phonological awareness abilities of the sample. However, as per the norm of other studies, only the Deletion score will be used for the multivariate analyses in this study (e.g. Georgiou *et al*. 2008, Moll *et al*. 2014, Malda *et al*. 2014). Deletion tasks are also shown to be more reliable measures of phonological awareness (Yopp 1988).

Table 20: Phonological Awareness Task

Linguistic Unit (counter-balanced)	Task (presented in the same order to each participant)
Syllable	Segmenting Identification Deletion
Phoneme	Segmenting Identification Deletion

A one way ANOVA showed that the order in which the linguistic units were presented did not affect mean achievement in the Segmenting, Identification and Deletion scores ($F(3, 48) = 0.08$, $p = .97$, $\eta p^2 = .005$). Thus, there are no order effects in the phonological awareness task. This means that, whether participants manipulated phonemes or syllables first did not have an effect on their overall score. Participants can therefore be analysed as one group.

The results of the phonological awareness task are addressed in detail in order to answer Research Question 1 which asks:

1. What are the phonological awareness levels of Grade 3 isiXhosa readers/speakers?
    a. What linguistic aspects of isiXhosa, or other factors, affect phonological awareness in isiXhosa?
    b. How best can phonological awareness be measured in isiXhosa?

These questions are answered by looking at the mean scores and the distributions of the scores on the phonological awareness tasks by comparing scores across task type and linguistic unit. The mean and standard deviation provide a heuristic to understand the distribution of the data, but graphic representations of the data are inspected in order to confirm interpretations. This graphic inspection supports the conclusions of which tasks are too easy or too difficult for the whole sample, and for only some people in the sample. An analysis of the errors that were made on each task type also confirms which tasks are too easy or difficult, but provides an understanding of the reasons for the difficulty. The analysis of the errors, coupled with a bimodal distribution found in the Deletion data warranted the splitting of the whole sample into two smaller samples according to the types of errors they made. These two smaller groups are then analysed for how word length, orthographic representation, position of the unit in the word and school affected performance. Finally the data are used to conclude whether the phonological awareness tasks used in this study were suitable or not.

4.5.1 Accuracy on phonological awareness tasks

Accuracy on the phonological awareness tasks was reported earlier in Table 17 (p.94); the relevant section is reproduced as Table 21, below.

Accuracy on the phonological awareness tasks varied according to the task, and linguistic unit targeted, as well as other factors which are expanded on in the following sections. The general trend in the data is that performance is better when syllables are targeted. When looking at the task composite scores the trend is that deletion is the most difficult task, followed by segmenting, and that identification is the easiest task. When looking only at performance on the tasks when syllables are targeted, the data clearly follow the task hierarchy presented in the literature. However, when looking at the tasks where phonemes were targeted segmenting is the most difficult. These trends in linguistic unit difficulty and task difficulty are explored in more detail in §§4.5.4 and 4.5.5, respectively.

Table 21. Phonological Awareness Scores (reproduction of relevant section of Table 17)

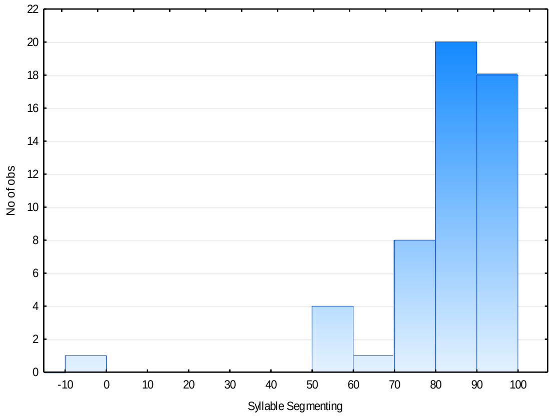
Variable/Task	Mean (*N*=52)	(*SD*)	Min	Max
Phonological Awareness Task[b]				
Segmenting[b]	**53.0**	**(11.2)**	**30**	**80**
Syllables[b]	*87.4*	*(16.8)*	*0*	*100*
Phonemes[b]	*18.6*	*(17.2)*	*0*	*60*
Identification[b]	**56**	**(24.9)**	**15**	**95**
Syllables[b]	*66.7*	*(30.5)*	*0*	*100*
Phonemes[b]	*45.2*	*(35.1)*	*0*	*100*
Deletion[b]	**46.5**	**(29.5)**	**0**	**95**
Syllables[b]	*51.9*	*(28.5)*	*0*	*100*
Phonemes[b]	*41*	*(36.3)*	*0*	*100*

Units: [b]percentage

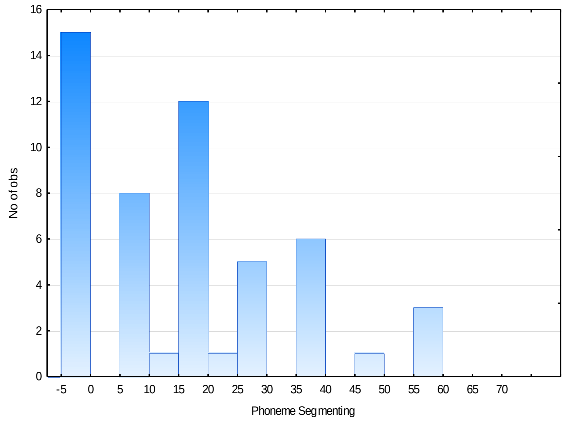
4.5.2 Distributions of the phonological awareness data

The statistics of central tendency reported for some of the tasks prompted further investigation into the data. The means and standard deviations of syllable segmenting (*M* = 87.4, *SD* = 16.8), phoneme segmenting (*M* = 18.6, *SD* = 17.2), phoneme identification (*M* = 45.2, *SD* = 35.1) and phoneme deletion (*M* = 41, *SD* = 36.3) suggested that the data be visually analysed (Simon 2008). Visual examination of the data revealed that syllable segmenting is almost at ceiling level (Figure 9 (a)), phoneme segmenting is at floor level (almost 30% of participants score 0%) (Figure 9 (b)), and phoneme identification (Figure 9 (c)) and phoneme deletion (Figure 9 (d)) have a bimodal distribution.

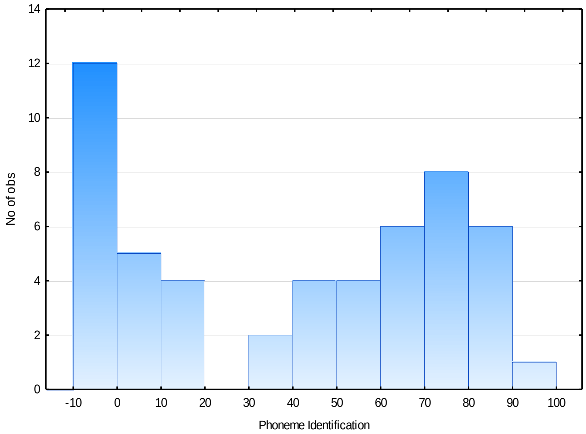
Ceiling effects in the syllable segmenting task provide evidence that this task was very easy for participants. The larger linguistic unit, the syllable, meant that segmenting the nonwords was very easy. Segmenting was also the easiest phonological awareness task used in this study. As a consequence, the majority of participants performed above 80% accuracy. Syllable segmenting was also shown to be a very easy task in another study but on Grade 4 isiXhosa readers (Diemer *et al*. 2015). In contrast, the segmentation of phonemes was not performed very accurately. It can be concluded that the difficulty here is due to phonemes being targeted since the syllable segmenting task was so easy. Explanations for this finding are given in §4.5.5 where task difficulty is addressed.



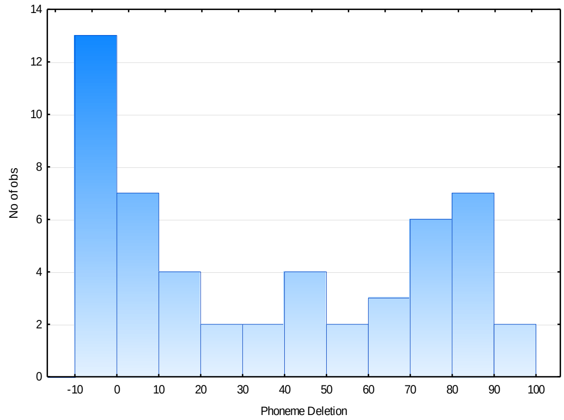
(a) Syllable Segmenting



(b) Phoneme Segmenting



(c) Phoneme Identification



(d) Phoneme Deletion

Figure 9. (a) - (d) Histograms of syllable segmenting, phoneme segmenting, phoneme identification and phoneme deletion

A bimodal distribution of results was found for phoneme identification and phoneme deletion in the current study. Caravolas and Bruck (1993) report that their phoneme identification task (where the first sound of a nonword was identified) resulted in bimodal distributions for Czech and English speaking monolingual prekindergarteners. Caravolas and Bruck (1993) concluded that this distribution indicated that some participants were not able to do the task because they had not yet reached sensitivity to the phoneme. It is interesting to have found a similar result in isiXhosa when the children in this sample have been in school for three years, and therefore should all be able to manipulate phonemes. Caravolas and Bruck (1993) overcame the non-normal distribution by excluding the participants who could not do the task and replacing them with participants who could. It was not possible to sample more participants for my study so an alternative approach suited to the current study was used.

In line with the argument of Caravolas and Bruck (1993) the bimodal distribution of data found for phoneme identification and deletion reflect characteristics in the current sample, rather than of the task. The low levels of performance by some participants on the phoneme identification and deletion tasks indicate that they are not yet adequately sensitive to phonemes. The data show that participants are either able to perform the phoneme tasks well, or not at all. This provides evidence that once phoneme awareness has been achieved there is a qualitative difference in readers' ability to manipulate phonemes.

Combining the scores for syllable and phoneme deletion did not improve the normaility of the data, and a bimodal distribution remained (Figure 10). A bimodal distribution is essentially when two distributions of data are included in the same sample, and so the only way to overcome bimodality is to find the two distributions. The bimodal distribution of the current sample therefore includes two groups which are qualitatively different. There is a need then to identify the two groups which differ in their sensitivity to phonemes so that they can be analysed separately so as not to lose the nuances in the trends of the data. Separate analysis is warranted because the groups are qualitatively different, primarily in their accuracy on the tasks. The question is how the different groups can be identified.

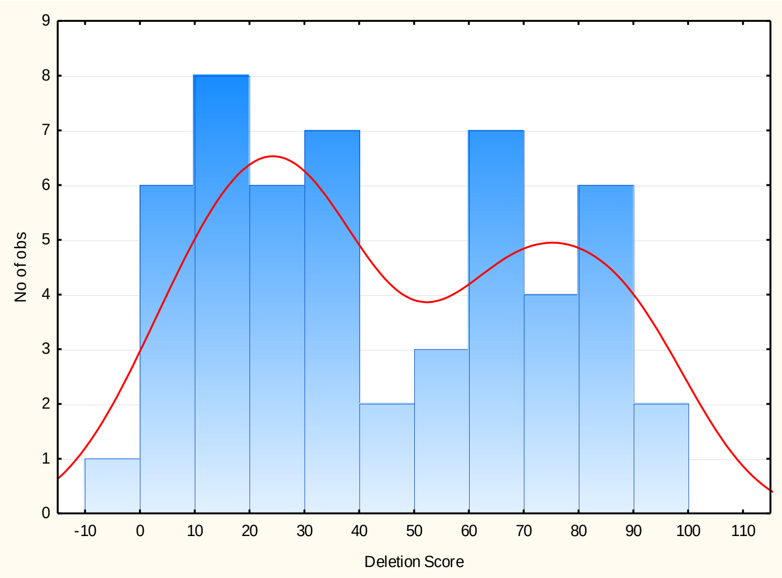


Figure 10. Bimodal distribution in the composite deletion score

Focus is directed to the Deletion task because the results of this task will be used in the multiple regression. The bimodal distribution in the Deletion data needs to be overcome. Visual examination of the data presented in Figure 10 reveals that the most logical place to split the groups is at the 50% performance line, which also splits participants almost equally into two groups. Although this is a defensible option to determine the two groups, it does not explain **why** there is a bimodal distribution (except that some participants are more inaccurate than others), or why 50% should be the cut-off point. Splitting the data at the 50% point is a simplification because there is a reasoned method to determine the two groups. The two groups included in the current sample differ in their accuracy on the tasks. An analysis of the errors made on this task shows that the groups also differ in the type and frequency of errors that they make. Thus, the more tenable method to find the two groups included in the current sample involves analysing the types and frequency of errors made in the deletion task. This is reported in the following section.

4.5.3 The types and frequency of errors on the phonological awareness task

Recall from Chapter 3 that the errors in the phonological awareness tasks were further coded so that the frequency of certain types of errors could be determined. The analysis of these errors is reported on in this section. This analysis is then used to allocate participants into two smaller groups.

Accuracy data remains important for understanding phonological awareness abilities for a given sample. However, analysing the type and frequency of errors for each task provides rich information as well. Previous research has not addressed the types and frequency of errors on phonological awareness tasks, missing out on this useful source of data. An analysis of the errors can highlight why certain tasks were answered inaccurately by highlighting that the instructions were not clear enough, for example, or that there was interference from orthographic representations. The information drawn from an analysis of the errors on the Deletion task can also be used to identify the two qualitatively different groups in this sample. I argue that some errors exist independent of task type, but that some errors shed light on the characteristics of the participants in the sample, primarily whether they are sensitive to phonemes or not.

My previous work on phonological awareness alerted me to the fact that errors made on phonological awareness tasks are not equal. That is to say, participants do not all make the same errors, and some participants who have the same accuracy score, may have made different errors. In another study on phonological awareness in isiXhosa, which used real words as stimuli, some errors were due to semantic interference from using real word stimuli (Diemer *et al*. 2015). Orthographic interference was also found such as when the letters of digraphs are spelled out (D-L-A-S-H-A-Z-A) instead of sounded out as [ɮ-a-ʃ-a-z-a].

4.5.3.1 The errors and what they indicate

A detailed explanation of the error coding system was provided in§3.4.2.3. An outline is provided below for ease of reference.

The current study used pseudowords as stimuli which are nonsense words which follow the CV structure and phonological constraints of the language to eliminate semantic interference. The types of errors coded for in this study are:

- phonological errors (one or more sounds were substituted in the response but the unit targeted and task performed were correct),
- orthographic errors (digraphs were spelled out, and not produced as the single sound they represent),
- task errors (the incorrect cognitive operation was performed, but with the correct linguistic unit),
- unit errors (where the incorrect linguistics unit was targeted, but the correct task was performed), and
- non-responses (participants opted out and did not give a response).

The frequency of these errors in each task sheds light on why the errors occurred.

I hypothesised that a high number of phonological substitution errors in the response (after the cognitive operation has been performed) is an indicator of deficits in the phonological loop of the working memory system (Alloway *et al*. 2004). Another interpretation is that phonological errors are a result of genuine slips of the tongue. Because a measure of verbal working memory was not included there is no way to establish if the former is true. Data from the tasks may be able to shed light on whether the phonological errors are due to slips of the tongue. Orthographic errors are caused by participants' knowledge of the orthographic representation of isiXhosa sounds, indicating a certain level of orthographic awareness (Landerl *et al*. 1996). Orthographic awareness has a positive relationship to reading (Manis *et al*. 2000) so a higher number of orthographic errors should indicate better readers. It should be the case that orthographic errors predominantly affect the phonemes tasks, especially segmenting and identification where single phonemes must be targeted. Task errors are a result either of misunderstanding the task (due to inadequate instructions, or lack of corrective feedback), or they indicate that the cognitive task is too difficult. Unit errors indicate either that participants are not aware of the different sizes of linguistic unit, or that they are confused as to what linguistic unit to target because of inadequate instruction or lack of corrective feedback. Non-responses may indicate difficulty with completing the task, or a lack of understanding of what is required.

4.5.3.2 Frequency of errors on the phonological awareness tasks

The errors in each task were coded by types, and their frequency on each task was determined. Some tasks are more difficult than others and therefore have more errors, which would make a simple comparison of the frequency of each type of error problematic. To remedy this, the error types were calculated as a percentage of the total number of errors for each task. In this way, the ratio of errors per task can be compared. This was done to determine if certain tasks elicited certain errors, and indeed they did. The proportion of errors per task is presented in Figure 11.

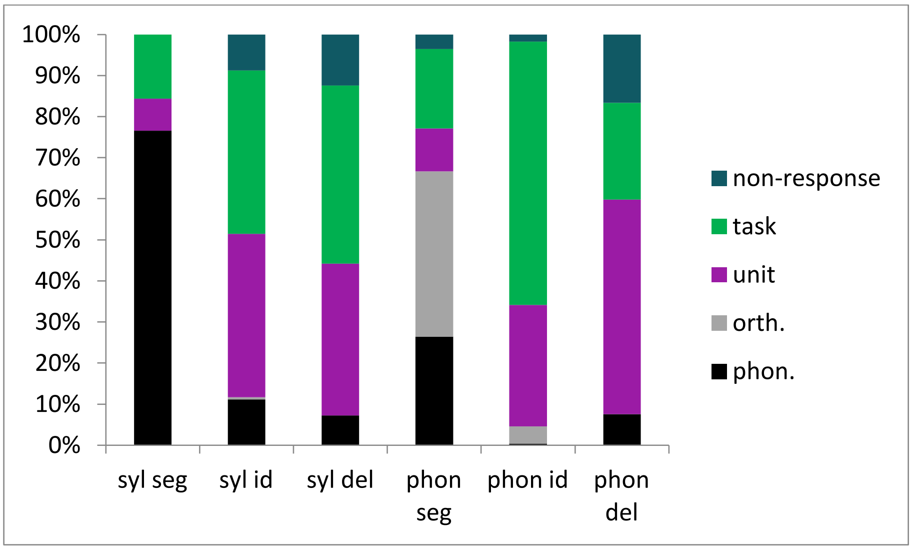


Figure 11. Frequency of errors on phonological awareness tasks

Syl seg = syllable segmenting; syl id = syllable identification; syl del = syllable deletion; phon seg = phoneme segmenting; phon id = phoneme identification; phon del = phoneme deletion

Figure 11 shows that there is a well-defined pattern of error frequency on the different tasks. Phonological substitution errors accounted for a small percentage of the errors across tasks except for the syllable segmenting task, where phonological substitution errors were in the majority. Recall that the mean score for the syllable segmenting task was very high. This indicates that when participants did make errors, they were more likely to substitute some of the sounds in the response. The fact that phonological errors predominate in the easiest task provides evidence that they may be a result of slips of the tongue. Secondly, these errors occur more frequently in the phoneme segmenting task as well for this reason. The interpretation that phonological errors are due to deficits in phonological working memory was not met. If this were the case, then the most phonological errors would be found in the deletion tasks, which place the highest load on working memory (Yopp 1988, Alloway *et al*. 2004), but the deletion tasks actually exhibit the least frequent number of phonological errors. Phonological substitution errors as a result of slips of the tongue can be reduced by specifically instructing participants to say the word exactly how they heard it.

As predicted, orthographic errors were most frequent on the phoneme segmenting and identification task, which specifically included stimuli which were spelled with digraphs. Digraphs were included in order to determine if orthographic representations affected performance. While orthographic errors were confined to two tasks, non-responses were less frequent but occurred in all tasks except the easiest, syllable segmenting. This confirms that non-responses arise out of difficulty with the task, resulting in participants opting out. This is supported by the evidence that shows the frequency of non-responses increases as task difficulty increases.

An error was classified as a task error when the correct operation in question was not performed e.g. in an identification task where the first segment should be identified but the participants identified the second segment. Earlier I stated that task errors reflect misunderstanding of the instructions, or general difficulty with the task. This is confirmed by Figure 11. Grouping task errors and non-responses together (because they both indicate misunderstanding on the task) shows that misunderstanding on the task increases as task difficulty increases, except for the case of phoneme deletion. This can however be explained by the fact that phoneme deletion targeted deletion of only the first phoneme, and is therefore an easier task than phoneme identification.

The most interesting type of error noted is unit errors, especially because it is these errors which assist in determining the two groups in the data. Linguistic unit errors arise when participants targeted a phoneme in the syllable tasks, or a syllable in the phoneme tasks. These errors therefore show that participants are not sensitive to the difference in the units. These errors are not an artefact of the task administration because examples were provided that showed which units to target, and tasks which targeted the same unit were administered together in the order of segmenting, identification then deletion. Lekgoko and Winskel (2008) also report unit errors in the phoneme deletion task administered to Setswana speakers.

Figure 11 shows that the frequency of unit errors actually increases as participants moved through the tasks. This means that with more practice, participants actually made more errors in determining which unit to target. The number of unit errors on the tasks is therefore not a reflection of the task demands, but of the participants themselves. Even after example trials, and blocking of linguistic units, some participants were still unsure of which units to target. Thus, participants who make more unit errors are more likely to not have reached the threshold for phoneme awareness. Data from a correlational analysis between error types and the final Deletion score shed more light on the relationship between particular errors and the final Deletion score.

4.5.3.3 The relationship between error types and final score

A Spearman correlation was run in order to determine the relationship between error types and the final score on Deletion. The correlation was run to determine if there are certain types of errors which have a stronger relationship to the final score. Of course, the more errors in general a participants makes on the tasks, the lower their final score. The two most common types of errors were task errors and unit errors. I argue that task errors are a result of difficulty with the task, and therefore affect all participants equally. On the other hand, unit errors are a reflection of the phonological awareness abilities of participants, indicating whether the threshold level of sensitivity to phonemes has been reached or not.

Table 22. Spearman correlations between errors on the deletion tasks and composite deletion score

	Deletion	Phon.	Unit	Task
Deletion	-			
Phon.	-.11	-		
Unit	-.73***	.02	-	
Task	-.59***	-.03	.24	-
Non-Responses	-.37**	.18	-.12	.29*

Significant correlations * p < .05 ** p <. 01 *** p <. 001

A Spearman Rank Order Correlation between Deletion and the errors made on the deletion tasks was performed to determine if any error types could shed light on why the bimodal distribution occurs (Table 22, above). The strongest relationship in the data was between Deletion and the number of unit errors ($r_{(s)}$ = -.73, p < .001). This relationship was negative: the more unit errors that were made, the lower the final score for deletion. Of course, it makes sense that the more errors a participant makes in general, the lower their deletion score. All the correlations between deletion and the errors was negative, but the data shows that the types of errors have different strengths of relationships with the final score for Deletion. The number of task errors to Deletion is moderate ($r_{(s)}$ = -.59, p < .001) and the number of non-responses to deletion is only weak ($r_{(s)}$ = -.37, p < .01). There is also evidence to show that non-responses are linked to difficulty with the task, rather than whether the targeted linguistic unit was a syllable or phoneme. The Spearman correlation between task errors and non-responses is positive but weak ($r_{(s)}$ = .29, p < .05) indicating that non-responses increase with task difficulty. None of the other error types correlate significantly with each other, re-emphasising the previous discussion that these errors have different causes.

If the bimodal distribution confirms that there is a threshold level to the sensitivity to phonemes, then whether a participant is sensitive to phonemes can be assessed by the number of unit errors made on the task. That is to say, if one is not sensitive to the different sizes of linguistic units, then one is more likely to make unit errors, decreasing the final score. Participants who make a high number of unit errors clearly are not sensitive to the difference in phonological size between the phoneme and syllable. Furthermore, the number of unit errors on the task has the strongest relationship with the final deletion score indicating that there is a strong relationship between the two. Figure 12 presents the scatter plot of unit errors to Deletion, and is fitted with a linear line indicating the negative relationship. Because the number of unit errors had the strongest relationship with the final Deletion score, and because this relationship follows the theoretical understanding of phonological awareness, participants were split into two groups according to the number of unit errors they made on the Deletion tasks.

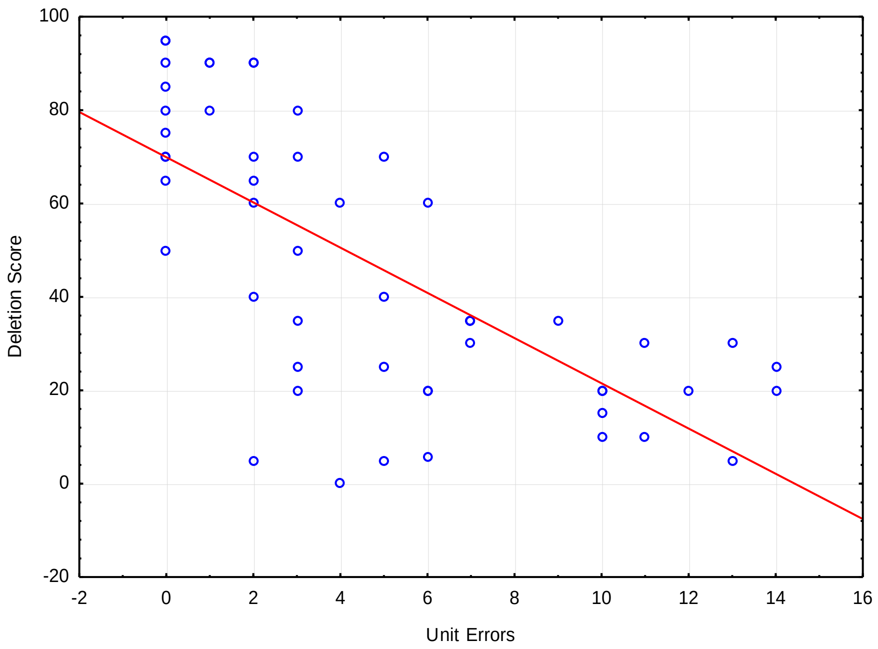
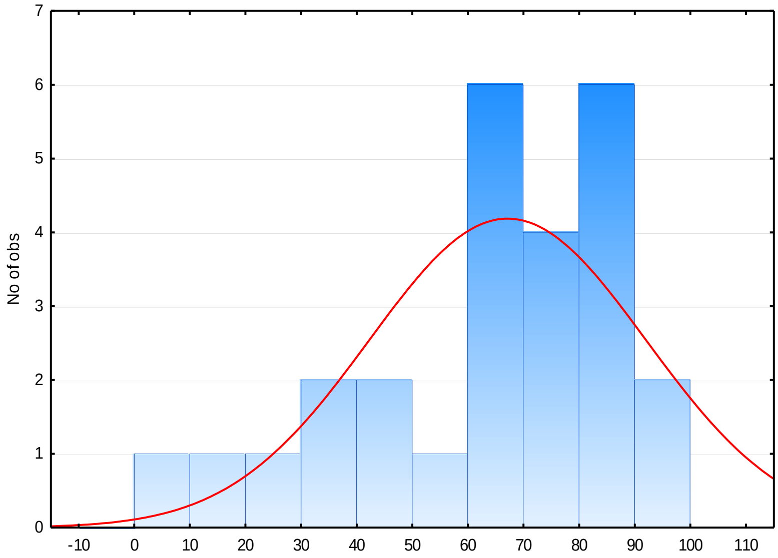
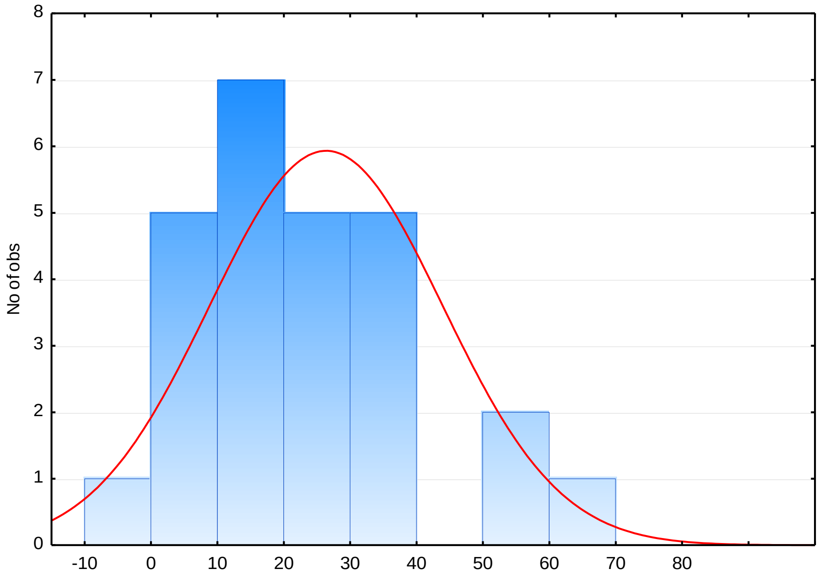


Figure 12. Scatter plot of number of Unit Errors and Deletion

The number of unit errors was not normally distributed so the median number of unit errors (3.5) was used instead of the mean (4.8). Participants were grouped according to whether their total number of unit errors was above or below the median. This resulted in two groups: Group 1 (N = 26) all made fewer than 3.5 unit errors, and Group 2 (N = 26) all made more than 3.5 unit errors. Splitting of the group adequately separated those participants who performed better on the task (Group 1) than those who performed worse (Group 1), thereby eliminating the bimodal distribution (Figure 13 (a) and (b)). The mean scores for each group are presented in Table 23.



(a) Group 1



(b) Group 2

Figure 13. (a) and (b). Histograms for Deletion scores for Group 1 and Group 2

Table 23. Phonological Awareness Scores for Group 1 and Group 2

	Group 1		Group 2	
Variable/Task	**Mean**	**(SD)**	**Mean**	**(SD)**
Phonological Awareness Task				
Segmenting	**53,35**	**12,79**	**52,69**	**9,65**
Syllables	*86,45*	*13,52*	*88,37*	*19,74*
Phonemes	*20,26*	*18,05*	*17*	*16,46*
Identification	**66,54**	**22,57**	**45,39**	**22,93**
Syllables	*73,46*	*31,87*	*60*	*28,14*
Phonemes	*59,62*	*32,31*	*30,77*	*32,12*
Deletion	**66,73**	**24,78**	**26,17**	**17,48**
Syllables	*69,23*	*24,81*	*34,65*	*20,39*
Phonemes	*64,23*	*29,69*	*17,69*	*25,97*

Independent t-tests confirmed that the two groups differed in their accuracy on the phonological awareness tasks (Table 23) for only syllable deletion ($t = 5.49$, $p < .001$), phoneme identification ($t = 3.23$, $p < .01$) and phoneme deletion ($t = 6.02$, $p < .001$). These are all the more difficult tasks, thereby emphasising the importance of using more than one measure of phonological awareness to elicit variation in the results. The frequency of errors made by the groups also differs (Figure 14).

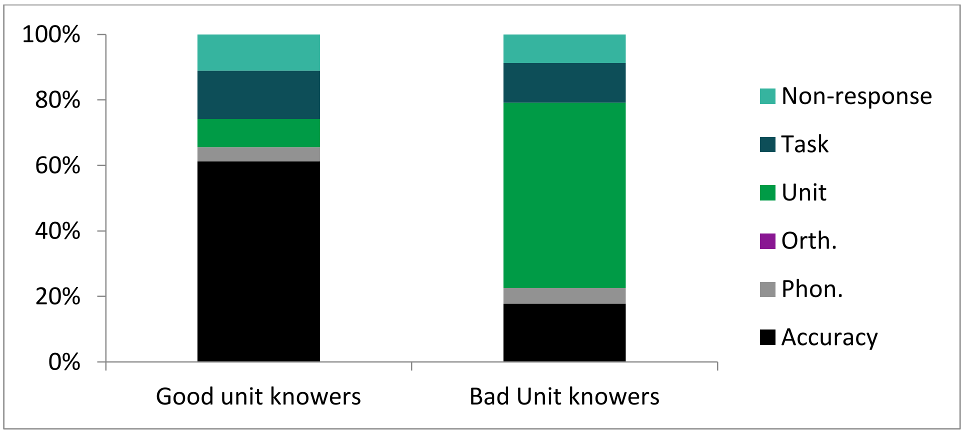


Figure 14. Percentage of Errors on the Deletion task by group

Analysis of the accuracy, and types of errors made on the deletion task (Figure 14) shows that the groups only differ on their accuracy, and the percentage of unit errors made, with group 2 having lower accuracy, and a higher number of unit errors. The percentage of phonological, orthographic and task errors was comparable across groups. The fact that the groups differ only in their accuracy, and the percentage of units errors made confirms that splitting the larger sample in this way was well-founded. Because the percentage of other types of errors are more or less similar for both groups this indicates that there was no confounding influence of another error type.

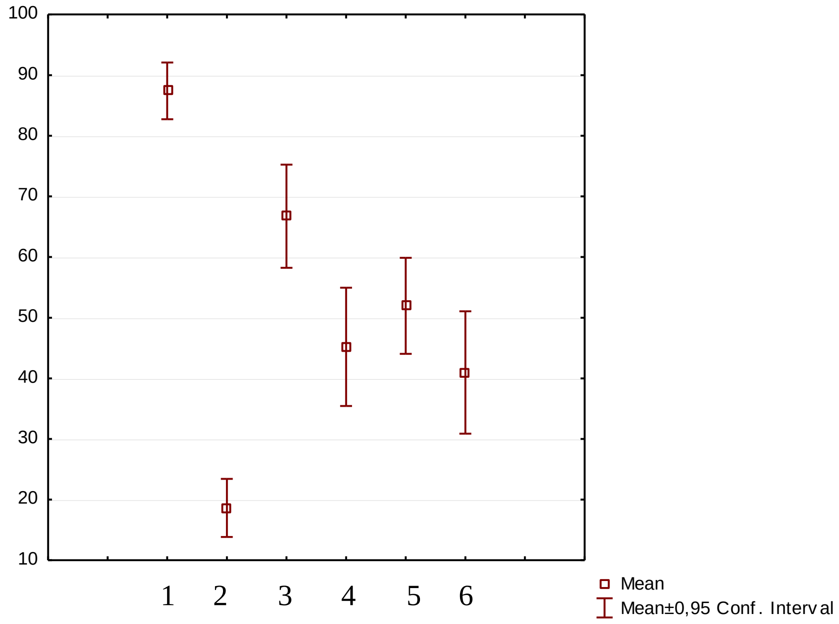
In summary, this data shows that accuracy, as well as the number of unit errors, are clearly the differentiators between the two groups, whereas the groups are comparable on the other types of errors. This indicates that the groups are qualitatively different from each other based on the sensitivity to the sounds in isiXhosa. Thus with reference to the first part of Research Question 1, Levels of PA differ according to whether participants have a sensitivity to the difference between phonemes and syllables. §4.5.3 also showed that an analysis of the errors made on phonological awareness tasks adds rich information about the suitability of the tasks, and the characteristics of the participants in the sample. Future research should also record the types of errors made in order to shed light on why errors are made on different tasks.

The remainder of §4.5 addresses the other factors which affect phonological awareness in isiXhosa, looking specifically at the influence of linguistic unit, task difficulty, word length, position of the unit in the word and orthographic influence. These factors are examined for the whole sample. Where there is evidence that one of the groups displays different trends to the whole sample, this is reported.

4.5.4 Linguistic unit difficulty

As expected, syllables are easier to manipulate than phonemes (Figure 15). A series of sign tests confirms that that mean syllable scores are higher than the mean phoneme scores for each task type in the whole sample (segmenting: $Z = 6.80$, $p < .001$; identification: $Z = 3.69$, $p < .001$; deletion: $Z = 2.56$, $p < .05$). The same is found for the two smaller groups, except for Deletion in Group 1. The syllable and phoneme deletion scores are not significantly different from each other in Group 1 because the phoneme deletion task was easier, targeting only the first phoneme. However, Group 2 still exhibited an advantage for the syllable, indicating that even first phoneme deletion is difficult for participants who are not very sensitive to the difference between phonemes and syllables.

The fact that syllables are easier to manipulate than phonemes in isiXhosa is in line with previous research. The same trend was identified for Grade 4 readers of isiXhosa (Diemer *et al*. 2015), and for English and other languages (Adams 1990, Ziegler & Goswami 2005). This finding is to be expected, firstly because syllable awareness is acquired earlier and secondly because syllables have prominence in isiXhosa because it has a large number of clearly defined CV syllables. On the other hand, the awareness of phonemes generally only emerges after exposure to print, and improves with literacy instruction.



Key

1 – syllable segmenting

2 – phoneme segmenting

3 – syllable identification

4 – phoneme identification

5 – syllable deletion

6 – phoneme deletion

Figure 15. Difference in performance by linguistic unit

What is interesting, however, is that the transparent nature of isiXhosa writing should mean that phoneme awareness should be closer to syllable awareness as is the case for Turkish and Italian (Cossu *et al*. 1988, Durgonoglu & Oney 1999). By first grade Turkish and Italian children can count out (a form of segmenting) phonemes almost as well as syllables (with a 2% difference in Turkish, and a 10% difference in Italian). This is because a transparent orthography makes it easier for readers to learn about phonemes because of the high consistency between letters and phonemes. Reading instruction further improves phoneme awareness (Mann & Liberman 1984).

In my study, the difference in performance between syllable and phoneme awareness varies according to the task. For the whole sample, the easiest syllable task, segmenting, is the most difficult phonemes task with a large 68.8% difference in accuracy. For identification, the difference lowers to 21.5%, and the deletion tasks differ in only 10%. The comparatively lower performance in phoneme segmenting to syllable segmenting has been reported for isiXhosa (Diemer *et al*. 2015) and KiSwahili (Alcock *et al*. 2010). Alcock *et al* (2010) concluded that this large difference is a result of teaching instruction where readers are not taught phonemic segmentation, and neither are they taught phoneme-letter correspondences. Rather, readers learn the letter names which is the consonant followed by a vowel. Given that phoneme awareness levels are affected by reading instruction this interpretation is tenable and may explain the finding in my data because a common literacy teaching method has been reported in schools which teach isiXhosa (de Vos *et al*. 2014). Questionnaires on teaching instruction were not administered to the teachers at the schools so this interpretation cannot be confirmed.

With reference to the other tasks, the difference in performance between syllables and phonemes for identification and deletion narrows as the tasks become more difficult but still present a large difference. Recall that phoneme deletion only targeted deletion of the first phoneme of the word, which should be relatively easy for this group who are in Grade 3. Performance on this task was still lower than that for the syllable version indicating that even deletion of the first phoneme in Grade 3 can produce a range of results.

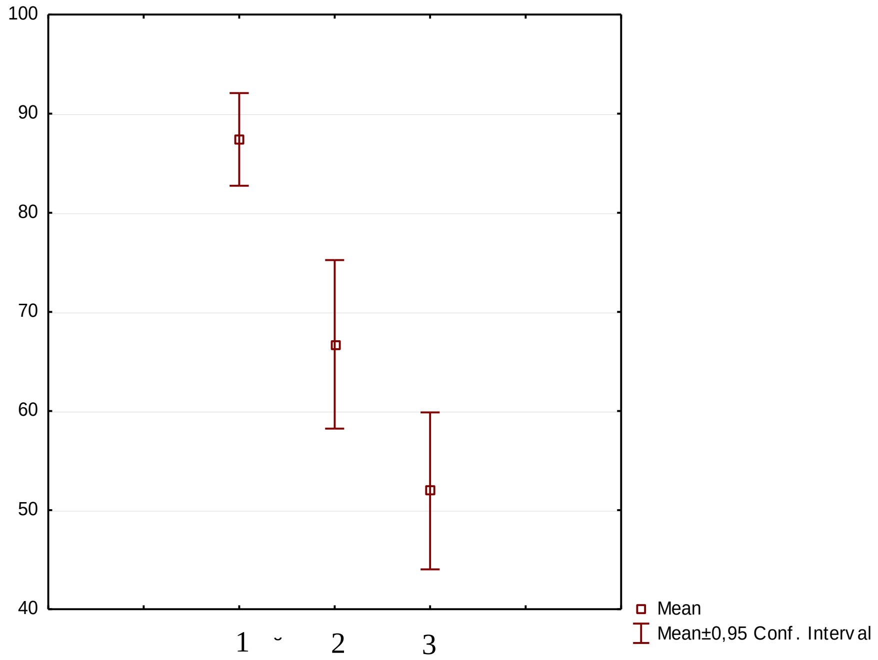
In summary, tasks which targeted syllables were performed better than tasks that targeted phonemes (except for the Deletion of Group 1). The best explanation for the difference in performance between syllables and phonemes in the tasks is two-fold: 1) the syllable is a highly available phonological unit because of the phonology of the language explaining its prominence over the phoneme and 2) teaching methods favour the syllable, rather than the phoneme. The similar results for Deletion in Group 1 is a result of the easier demands on the first phoneme deletion task. The next stage of analysis focuses on the task difficulty.

4.5.5 Task difficulty

As outlined in Chapter 3, the phonological awareness tasks were specifically created in order to tap a range of difficulties in order to ensure variability in the results. As mentioned previously, tasks clearly differed in their difficulty (evidenced by lower scores). However, the exact order of task difficulty depends on the linguistic unit that was targeted, and the group in question. This confirms the finding that task difficulty and linguistic difficulty interact. Task difficulty is explored by examining the scores of the tasks which targeted the same linguistic unit. By keeping the linguistic unit constant the effect of the task difficulty on performance can be determined.

4.5.5.1 Task difficulty: syllables

The trends in task difficulty are easier to see when syllables were targeted. For the whole sample (Figure 16 (a)), the data clearly follow the trend presented in the literature that segmenting is the easiest task, identification is intermediate and deletion is the most difficult. The data from Group 2 show this same trend (Figure 16 (b)). However, Group 1 showed a large range of performance in the identification task. This means that only the syllable segmenting and deletion tasks are significantly different from each other (Z = 2.24, p = .02), and identification is not significantly different from either segmenting or deletion. The reason for higher performance in all tasks for Group 1 may be because they have reached higher levels of sensitivity.



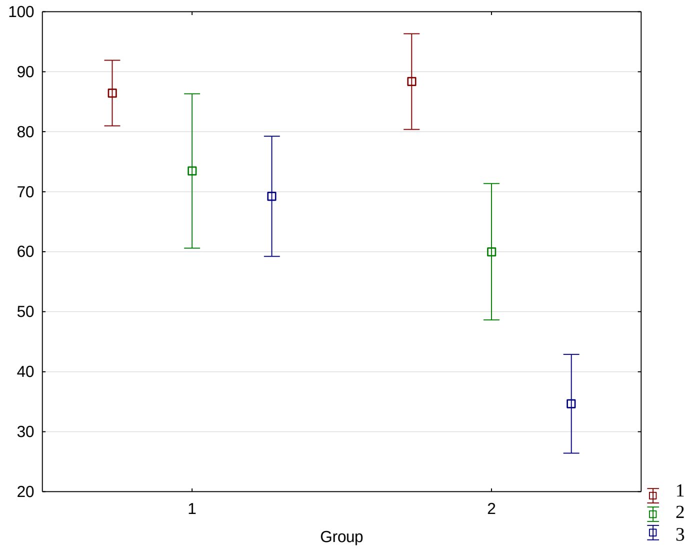
Key

1 – syllable segmenting

2 – syllable identification

3 – syllable deletion

(a) Whole sample performance on syllable tasks



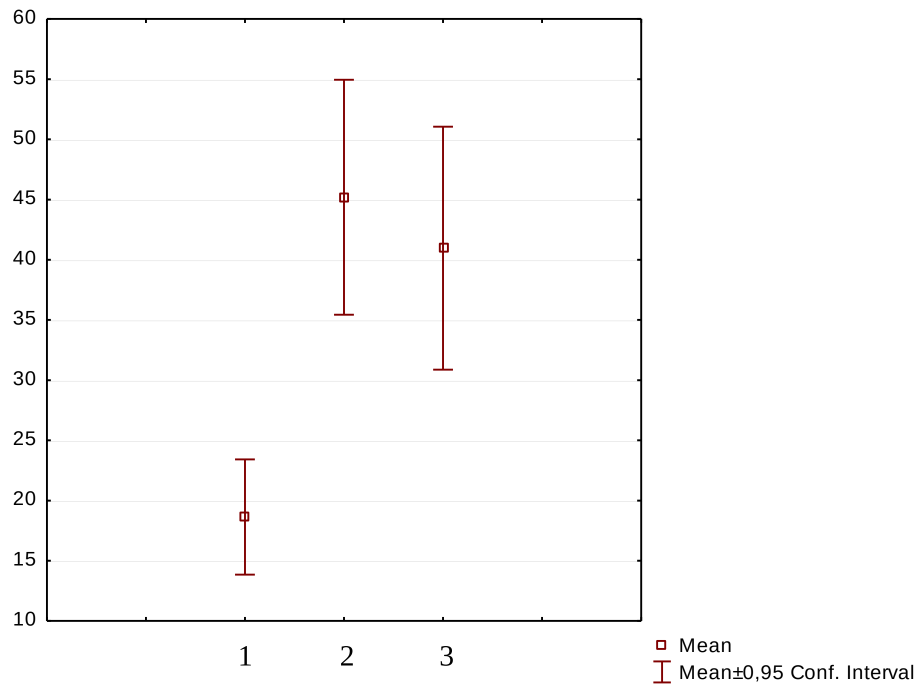
(b) Group 1 and 2 performance on syllable tasks

Figure 16. (a) and (b). Means plots for syllable performance

4.5.5.2 Task difficulty: phonemes

For the phonemes tasks, the clearest trend for the whole sample is that segmenting is the most difficult task because it has the lowest score (Figure 17 (a)). This is also exhibited in Group 1. Phoneme identification and deletion are of equal difficulty for both the whole sample and Group

1 (Figure 17 (b)). For Group 2, there is a general low level of performance on all tasks. Although identification does have slightly higher scores, this did not reach significance. The trend for the phoneme data is that segmenting is definitely the most difficult, and identification and deletion are easier. Considering that deletion only targeted the first phoneme, there is reason to believe that deletion would elicit lower performance had deletion been targeted at different positions in the word, thereby following the trend in the literature. The question then is why is segmenting phonemes so difficult for isiXhosa speakers?



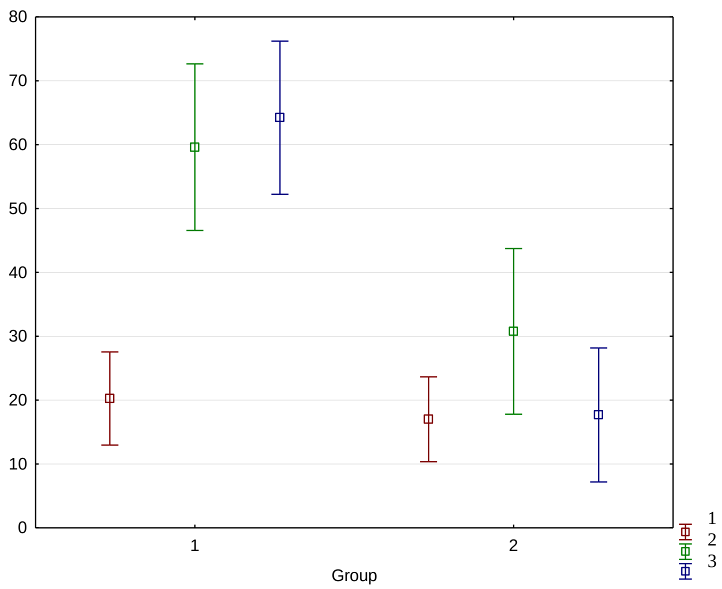
Key

1 – phoneme segmenting

2 – phoneme identification

3 – phoneme deletion

(a) Whole sample performance on phoneme tasks



(b) Group 1 and 2 performance on phoneme tasks

Figure 17. (a) and (b). Means plots for phoneme performance

In section 4.5.4 I argued that the large difference between syllable and phoneme segmenting performance was due to the influence of teaching methods, where the phoneme is not used as a unit for teaching. The influence of teaching instruction on phoneme awareness has been shown extensively (Adams 1990, Gillon 2004). If this argument explains the trend fully, then it should be the case that all phoneme tasks exhibit low levels of performance. For group 2, there is generally a low level of performance, and they do poorly on all tasks confirming this interpretation. But for Group 1, phoneme identification has a mean of almost 60% (*SD* = 32%) indicating that these participants are able to successfully identify phonemes. They can also delete the first phoneme of a nonword with relative success. The problem with the low score on phoneme segmenting does not seem to be so much the phoneme part only (because participants can manipulate phonemes in other tasks), or the task of segmenting (because participants can segment syllables). Data from the error types on this task shed more light on the matter.

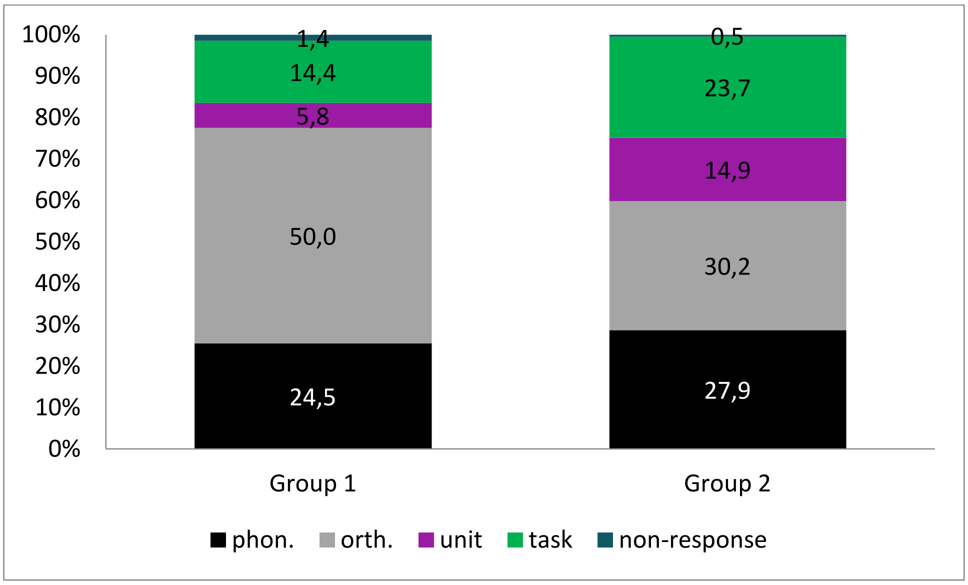


Figure 18. Frequency of errors on the phoneme segmenting task

Figure 18 shows the frequency of errors as a percentage of total errors for Group 1 and Group 2. It seems that phonological substitution errors account for a quarter of all errors for both groups. These errors indicate slips of the tongue, or the fact that the task places a load on working memory. The last 5 stimuli were 6 phonemes long so the load on working memory could have been great. It seems that perhaps participants changed some of the sounds because they could not remember the long list of sounds correctly. Evidence from an analysis of word length in §4.5.6 confirms that longer words were segmented more poorly in the phoneme task.

The most frequent error on the phoneme segmenting task was orthographic errors, highlighting the link between phonological awareness and literacy (Landerl *et al*. 1996). These errors show that participants are aware of how the phonemes in their language are represented orthographically. Orthographic errors may be a result of participants interpreting the task as a letter segmenting or spelling task, sounding out the letters rather than the phonemes. Recall from Chapter 3 that digraphs were specifically included so the effect of orthographic awareness could be examined. The fact that Group 1 and Group 2 differ in the percentage of these errors (50% vs 30% respectively) further provides evidence that the phonological skills of Group 1 surpass those of Group 2. Landerl *et al*. (1996) found that the influence of the orthographic representation of words in phoneme tasks was greater for better readers than dyslexic readers. It may be the case that Group 2 includes participants who are dyslexic.

Figure 18 also shows that task errors account for a quarter of all errors for group 2 and about 15% for Group 1. This is quite a large number of task errors and indicates that there is a need to improve the instructions for the task. The current study used puppets to help participants understand how to segment the sounds, but this may not have been very helpful looking at the percentage of task errors. The use of more examples and corrective feedback could also be used to improve scores. When a segmenting task is used for screening or diagnosis the use of sounds which are represented by only one letter is recommended in order to eliminate orthographic influence. Digraphs were purposefully included in the current study in order to tease out the role of orthographic representations on phonological awareness, but orthographic influence should be avoided when using the task for non-research purposes.

As expected, Group 2 also made more unit errors than Group 1 (about 24% vs 14%). The use of more examples and corrective feedback should reduce the percentage of these errors. However, it must be noted that participants who have not reached the threshold level for phoneme sensitivity will perform poorly on this task, even after corrective feedback is provided. This is because they have not ‘crossed’ the threshold to the sensitivity of phonemes.

In summary, the data from the frequency of errors on the phoneme segmenting task show that although teaching instruction may affect participants’ ability to segment non-words, other factors related to the task may affect performance. The high frequency of orthographic errors suggests that even though participants may not be taught via a phoneme approach, they have built up orthographic representations of the phonemes in isiXhosa. The analysis of the errors also shows that simply improving the instructions may benefit performance on the phoneme segmenting task.

4.5.5.3 Task difficulty: summary

The tasks which targeted the same linguistic unit were compared to determine task difficulty. The results are summarised in Table 24, below. Task difficulty interacted with the linguistic unit and whether the participants had reached sensitivity to phonemes.

Of the tasks included in this study, segmenting has been shown to be the easiest task, identification is an intermediate task and deletion is the most difficult (Anthony *et al*. 2003). In the syllable tasks this trend was followed. For the phoneme tasks, segmenting was the most difficult task, with identification and deletion being equally difficult. The equivalence of performance on phoneme identification and deletion are due to the easier deletion task, which targets only the first phoneme, whereas identification targeted the first, second and third phoneme. Although poor levels of phoneme segmenting have been reported before for isiXhosa (Diemer *et al*. 2015), the low results for phoneme segmenting found in the current study are also due to orthographic interference. Furthermore, more examples and corrective feedback can go a long way to explaining the tasks so participants understand the requirements better. The role of teaching instruction may also be responsible. Finally, when the sensitivity to phonemes has not been reached, phoneme tasks are equally difficult, as evidenced by the performance of Group 2 on the phoneme tasks.

Table 24. Summary of phonological awareness task difficulty in isiXhosa

Literature e.g.					
Anthony *et al*.(2003)	Segmenting[a]	>	Identification[b]	>	Deletion[c]
Syllable Tasks					
Whole Sample	Segmenting[a]	>	Identification[b]	>	Deletion[c]
Group 1	Segmenting[a]	=	Identification[ab]	=	Deletion[b]
Group 2	Segmenting[a]	>	Identification[b]	>	Deletion[c]
Phoneme Tasks					
Whole sample	Segmenting[a]	<	Identification[b]	=	Deletion[b]
Group 1	Segmenting[a]	<	Identification[b]	=	Deletion[b]
Group 2	Segmenting[a]	=	Identification[a]	=	Deletion[a]

(Use of letters marks the differences or similarities in scores)

In conclusion, the hierarchy of task difficulty presented in the literature is also observed in isiXhosa for syllables, and partially for phonemes. Phoneme segmenting proves to be a very difficult task in isiXhosa, but if orthographic interference is eliminated and better instructions are used, better performance on this task could be elicited. However, the role of teaching may mean that phoneme segmenting will not be found as the easiest task if the phoneme segmenting of words is never done in school. Phoneme identification would be found to be an easier task than phoneme deletion had phoneme deletion targeted phonemes n different positions in the word.

The influence of linguistic unit difficulty and task difficulty has been established. The remainder of section 4.5 explores how the characteristics of the nonword stimuli affected performance on the phonological awareness tasks. These aspects include word length, position of the unit in the word, and the influence of complex orthography.

4.5.6 Word length

The stimuli used in the phonological awareness tasks ranged in the length of words used. Word length is of specific importance to the segmenting tasks. Three and four syllable nonwords were used for the syllable segmenting task and two and four syllable nonwords were used for the phoneme segmenting task. Of interest here, is whether word length played a role in the ease of segmenting nonwords into syllables and phonemes in isiXhosa. Demands on working memory are increased as word length increases because there are more segments for participants to pay attention to (Leinonen *et al*. 2001). Since no research has yet examined what the ideal length of the stimulus is for isiXhosa PA tasks, stimuli were controlled for length in order to determine the effect of the length of the stimulus on the final result.

Word length affected performance on the phoneme segmenting task and not the easier syllable segmenting task. This effect was similar for both groups. A one way ANOVA indicated that the two groups were equivalent on their segmenting abilities ($F(4,47) = 0.19$, $p = .94$, partial eta squared = .02).

Table 25 presents the mean scores for the tasks in the different length conditions. There is a trend that scores decrease as word length increases which reaches significance for phoneme segmenting. For syllable segmenting, three syllable words ($M = 87.9$, $SD = 19$) were slightly easier to manipulate than four syllable words ($M = 86$, $SD = 18.5$) but a sign test showed this to be non-significant ($Z = 0.83$, $p = .40$). On the other hand, word length clearly affected phoneme segmenting scores: 3 syllable nonwords ($M = 12.8$, $SD = 15.4$) were more difficult to segment into phonemes than 2 syllable nonwords ($M = 24.3$, $SD = 23.5$) ($Z = 3.46$, $p < .001$).

Table 25. The effect of word length on segmenting ability

	Word legnth	Mean	*SD*
Syllable segmenting	3 syllables	87.9	*19.0*
	4 syllables	86.0	*18.5*
Phoneme segmenting	4 phonemes	24.3	*23.5*
	6 phonemes	12.8	*15.4*

These findings can be explained with reference to linguistic difficulty. Because syllables are easier to manipulate, lengthening the stimulus nonword did not make a difference in ease of syllable segmenting. However, phonemes are difficult to manipulate in the first place. For this reason, increasing the length of the stimulus significantly adds to the difficulty level. This finding shows that the length of the stimulus needs to be controlled in phonological awareness measures, especially for those that measure phoneme awareness.

4.5.7 Position of the unit

Not only is word length a factor to consider in phonological awareness tasks, but the position of the unit to be targeted is also a factor that may affect performance (Diemer *et al*. 2015). Studies on languages with closed syllables report position of the unit effects within monosyllables, where depending on the language spoken, the word initial consonant is easier to manipulate than the final consonant (Saiegh-Haddad *et al*. 2010). However, my study looks at the position of the unit in multisyllabic words, not monosyllables. Little research is reported on positioning effects in multisyllabic words.

Diemer *et al*. (2015) found an effect of position in the word when manipulating the phonemes and syllables of 2 syllable real words. In their study on real word substitution, they found that the second syllable and the word medial consonant of two syllable words were significantly easier to substitute than the first syllable or phoneme. They argued that this positioning effect was a result of the morphology of isiXhosa, where morphological changes take place at the second syllable or phoneme consonant of verbs. Whether a similar finding would be found with nonword stimuli is examined in the current study. It could be predicted that the influence of morphology was increased in the study by Diemer *et al*. (2015) because of the use of real word stimuli. If morphology affects the speaker’s representation of sounds then it should be the case that a similar finding would be made in the current study. On the other hand, if the morphological influence was due to real word semantic interference then there should be no advantage for the last syllable position when nonwords are used as stimuli.

The identification and deletion tasks used in the current study required units in different positions in three syllable nonwords to be identified, or deleted respectively. The syllable identification task required participants to identify the first (word initial), second (word medial) or third (word final) syllable of a three syllable nonword. The phoneme identification task required participants to identify the first (word initial), second (first vowel) or third (second consonant) phoneme of a three syllable nonword. The syllable deletion task targeted deletion of syllables in the first (word initial), second (word medial) or third (word final) position of a three syllable nonword. The phoneme deletion task, for reasons outlined in Chapter 3, required only the first phoneme to be deleted. The first phoneme differed as to whether it was an orthographically simple consonant (one letter – one sound) or an orthographically complex consonant (two or more letters – one sound). In this section, the syllable and phoneme identification and syllable deletion tasks will be discussed with reference to the effect of the position in the word. Phoneme deletion and orthographic interference will be treated in section 4.5.8.

There are a number of predictions, which are not mutually exclusive, for which positions should show better performance. These interpretations come from the influence of:

1. working memory and processing capacity,
2. morphology
3. orthography-phonology interactions

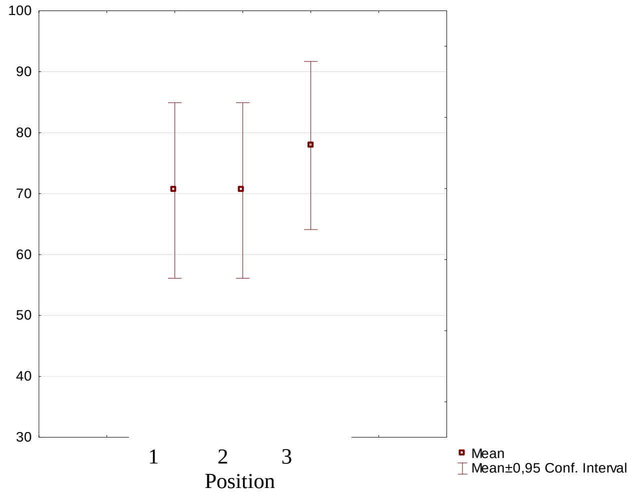
The first interpretation rests on viewing the identification and deletion tasks as placing a load on working memory, in which case constraints on this system should affect performance on the identification and deletion tasks. Working memory has been shown to show serial order effects. That is to say, when items must be recalled, items in the first position are recalled with the greatest accuracy (called the primacy effect), accuracy tails off for everything after the first position, and then accuracy increases at the final unit to be recalled but does not reach accuracy levels as high as that for the first position (called the recency effect) (Hurlstone *et al*. 2014). This view predicts that deletion and identification of the first unit should have the highest accuracy, followed by the final unit, with the middle unit having the lowest accuracy. With reference to the phoneme identification task, the first phoneme should be the easiest to identify, followed by the vowel, followed by the second consonant because all the sounds are at the beginning of the word. However, because working memory was not tested in this study, this interpretation is only tentative. Alternatively, learners could have normal ranges of working memory capacity but may be constrained by limited processing capacity. That is to say, learners may be ablt to hold all the units in working memory, but may only struggle because of the requirement of manipulating the auditory information because of limited processing capacity. In interpretation of the findings below, all claims of working memory and processing capacity deficits are very cautious.

If morphology plays a role in phonological awareness, it would be expected that the last syllable should be the easiest to identify or delete because verbal morphology causes changes at the end of the root, and rarely at the beginning. For phoneme identification, the role of morphology is less clear. Since some words start with CV affixes, it may be predicted that the second consonant is just as easy to identify as the first phoneme. With specific reference to the phoneme identification task, and the fact that the phonology and orthography of a language affects awareness of certain segments, it may be expected that the vowel (second unit) is the easiest to identify because there are only 5 vowel phonemes, represented by the same letters, thereby cementing letter-sound knowledge. Evidence from the phoneme segmenting task shows that participants may be accessing the spelling of the sounds to solve the task.

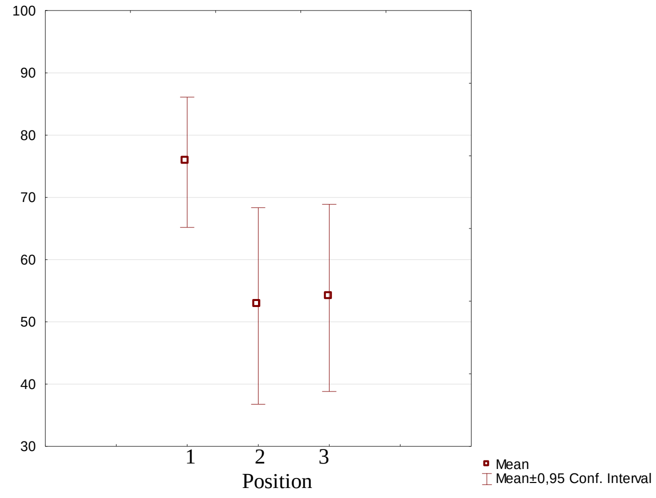
Groups 1 and 2 were equally adept at identifying the first unit of the words, but differed in their ability to identify units in other positions. A one way ANOVA indicated that the two groups differed in their performance on some of the comparisons ($F(9, 42) = 4.05$, $p < .001$, *partial eta squared* = .46). Post hoc Fisher LSD analysis revealed that the groups differed on identification of the third syllable ($p = .02$), deletion of the second syllable ($p < .001$), deletion of the third syllable ($p < .001$), identification of the second phoneme ($p < .01$), and identification of the third phoneme ($p < .001$). For this reason, the groups were analysed separately. The results for each group for each position in the word are presented in Table 26 and the means plots are presented in Figure 19. The means plots are compared to determine if the position of the unit in the word affects performance, thereby highlighting language specific effects on phonological awareness if they exist.

Table 26. Results of the syllable and phoneme identification and syllable deletion tasks by position

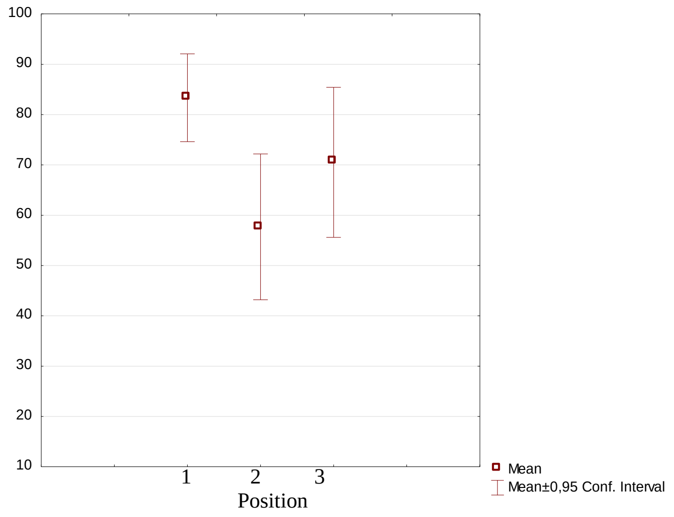
Group 1							
		Position 1		**Position 2**		**Position 3**	
Unit	**Task**	**M**	***SD***	**M**	***SD***	**M**	***SD***
Syllable	Identification	70.5	*35.7*	70.5	*35.7*	77.9	*34.2*
	Deletion	83.3	*21.6*	57.7	*35.9*	70.5	*36.9*
Phoneme	Identification	53.8	*34.1*	67.9	*41.6*	57.7	*38.5*
Group 2							
		Position 1		**Position 2**		**Position 3**	
Unit	**Task**	**M**	***SD***	**M**	***SD***	**M**	***SD***
Syllable	Identification	75.6	*25.9*	52.6	*39.1*	53.85	*37.2*
	Deletion	68.6	*34.1*	14.4	*25.7*	28.2	*33.6*
Phoneme	Identification	41.0	*43.5*	30.8	*43.1*	23.1	*29.1*



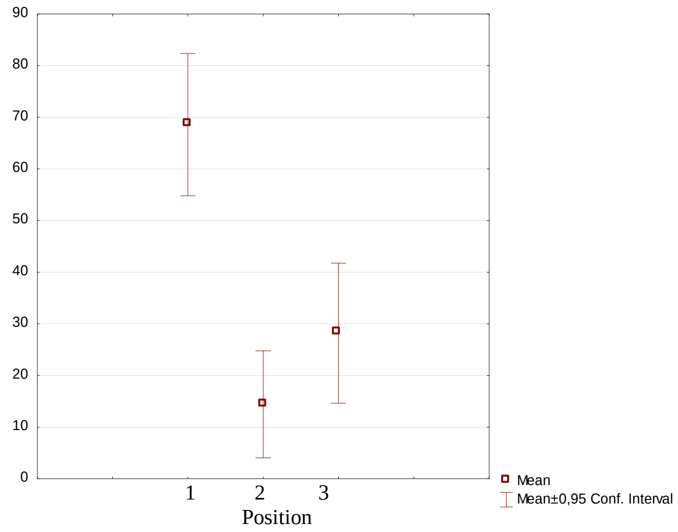
(a) Group 1: syllable identification



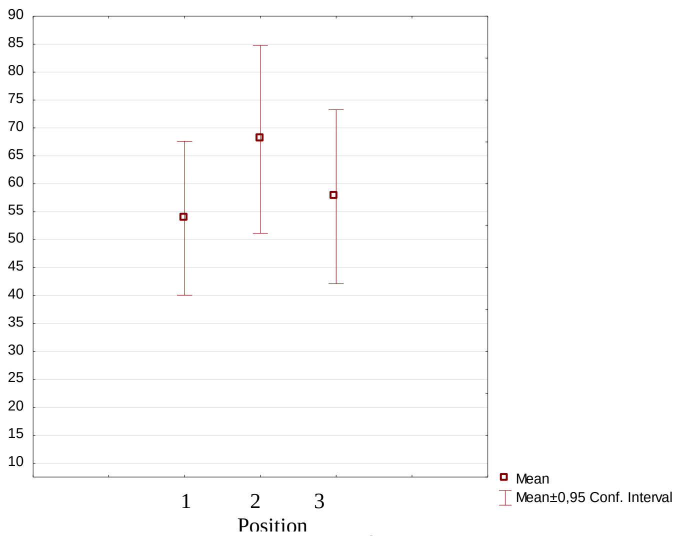
(b) Group 2: syllable identification



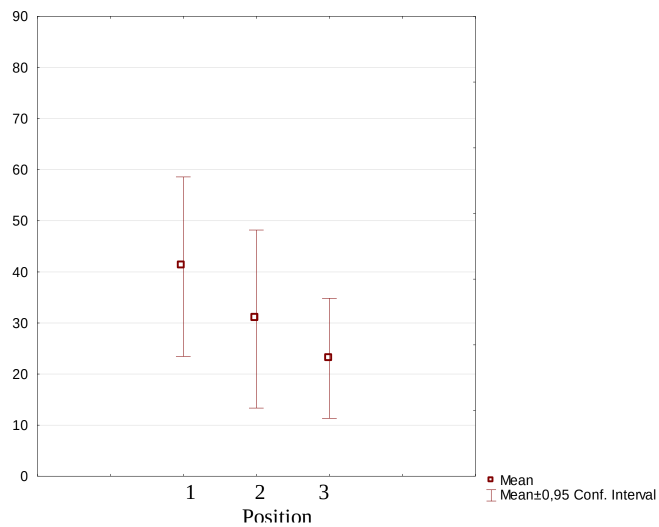
(c) Group 1: syllable deletion



(d) Group 2: syllable deletion



(e) Group 1: phoneme identification



(f) Group 2: phoneme identification

Figure 19. (a) – (f). Means plots of performance at different positions in the word for syllable and phoneme identification, and syllable deletion

4.5.7.1 Position in the word in syllable identification

The position of the unit in the word affected performance differently for Group 1 and Group 2 suggesting that participants who are more phonologically aware use different strategies to those who are not.

For group 1, all units were identified with equal accuracy, although the last syllable tends to be easier to identify. This finding supports evidence that morphology may affect phonological awareness abilities in isiXhosa, at least for phonologically aware speakers because the last syllable is easier to identify for Group1. The finding that the first and middle units were equivalent for group 1 could perhaps also suggest that morphology plays a role. In a three syllable word, the second syllable is usually the start of the root morpheme. The identification of units at this position is therefore beneficial for reading comprehension. The trend presented in Group 2 provides evidence for the working memory/ processing capacity predictions where the first unit was the easiest to manipulate. Performance on the middle and last syllable are equivalent showing that a recency effect probably did not affect performance, however.

4.5.7.2 Position in the word in syllable deletion

For the more difficult syllable deletion task, the same trend was observed for both Group 1 and Group 2 which suggests that working memory and/or processing capacity may have played a role in this demanding task (Yopp 1988). The first syllable was the easiest to identify. The last syllable was the second easiest and the middle syllable was the most difficult to delete.

For Group 1, the performance on the last syllable is not statistically different from the first syllable (Z = 1.03, p > .05) indicating once again that morphology may play a role in improving the awareness of the last unit so that it can be manipulated with as much ease as the first presented unit. Again, Group 2 does not show the potential influence of morphology because there is a much larger gap between the first unit deletion and last unit deletion. The trend that Group 1 has better middle syllable deletion abilities than Group 2 could indicate that Group 1 has better working memory, or that Group 1 participants visualize the word before performing the task. The errors on the phoneme segmenting task indicate that Group 1 could use word visualization as a tactic to help them solve phonological awareness tasks.

4.5.7.3 Position in the word for phoneme identification

Comparisons for phoneme identification again reveal that Group 1 and Group 2 differ. For Group 1, there is a trend that the first and second consonant phonemes can be identified with the same ease, but the vowel is identified more easily than the consonants. For phoneme identification, again morphology may play a role, because the second consonant (which would be the start of the root morpheme) is identified as easily as the first consonant phoneme. The fact that the vowel was more easily identified could be due to orthographic and phonological factors where there are only 5 vowels which enable high levels of awareness of these sounds. For Group 2, again, there was no apparent influence of morphology or orthography. Performance decreased according to the working memory/processing capacity explanation: the first phoneme was the easiest to identify and performance decreased in the second and third unit.

4.5.7.4 Position in the word: summary

The ability to manipulate units in different positions in the word in isiXhosa may be affected by constraints on working memory and/or processing capacity, where initial units (syllables or phonemes) seem to be easier to manipulate or identify, showing primacy effects. While this may be the case for both groups, there is evidence from speakers who have reached sensitivity to phonemes, and have higher levels of phonological awareness, that the morphology of isiXhosa may play a role in furthering phonological awareness, thereby, resulting in the last unit being as easy as or easier to identify or manipulate than the first unit. This influence of morphology can be seen even though the stimuli were nonwords.

An effect of morphology on the ability to manipulate units at different positions in the word has been identified in isiXhosa (real words) (Diemer *et al*. 2015) and Turkish (nonwords) (Oktay & Aktan 2002). Evidence from the current study adds to this growing body of literature on language-specific effects on phonological awareness. Caution must be advised in making strong claims about any positioning effects, however. The data are taken from the individual tasks which totalled 10 stimuli each. This means that the data for each position in the word is based on at most 4 observations per participant. Nevertheless, the identified trends create a precedent that future studies could examine in detail.

In contrast, speakers from Group 2 who have not reached high levels of sensitivity to phonemes do not provide evidence of an influence of morphology. Their ability to manipulate units at different positions in the word seems to be affected wither by working memory or processing capacity, where everything after the first unit is more difficult to recall, with improvement being seen in the last unit and the worst performance in the middle unit. The finding that the two groups show different trends in performance has not been reported in the literature to my knowledge.

Future studies should include measures of phonological working memory in order to tease out the potential role of working memory's effect on the position of the unit in the word.

Many tentative explanations can be offered which require more inspection with larger groups. The question of interest here is "why does Group 1 show an apparent influence of morphology on phonological awareness, but not Group 2?".

The difference between the two groups sheds light on the matter: Group 1 and Group 2 differ in their accuracy on the phonological awareness tasks, and Group 2 makes more unit errors, suggesting that Group 2 does not have high levels of phonological awareness. Although Group 1 and 2 do not have statistically significant fluency and accuracy differences, Group 1 reads on average 6 words per minute more than group 2, and is on average about 20% more accurate than Group 2. In a larger sample the differences in reading ability may have reached significance.

In the first place, Group 1 may have better metalinguistic awareness in general. Participants in this group may be more metalinguistically aware and can therefore supplement their knowledge of the sound system, with frequent occurrence of manipulations in the morphological system. This metalinguistic awareness could be missing from group 2. Another interpretation is that the good PA levels of Group 1 enable them to read better, which enables them to learn more about the morphology in isiXhosa which may in turn supplement their existing knowledge of phonemes and syllables. Group 2 however does not have high levels of phonological awareness, making reading more difficult, making it more difficult to learn from reading. This argument is in line with the well-established finding that PA and literacy are reciprocally reinforcing, and the occurrence of Matthews effects (Stanovich 2000).

Another interpretation is that the readers in Group 1 are better at the task, rather than the position of units. The task of identifying syllables and phonemes in a word could be enhanced through reading with a focus on the morphological units for meaning. In this way, learners are better at identifying initial and final syllables for changes in meaning, and for phoneme awareness this ensures that identification of the second consonant is as good as identification of the first. This interpretation implies that Group 2 does not read in this manner. Rather Group 2 readers should use a letter by letter approach because they may be unaware that larger units of meaning which are more accessible are available.

Data from the position of the unit in the word indicate that there are language-specific effects on phonological awareness for some readers. More research is needed to specify why this may be so.

4.5.8 Influence of orthography

The discussion on the difficulty in the phoneme segmenting task (§4.5.5.2), and evidence that the vowel phoneme is easier to identify than the consonants (§4.5.7.3), highlighted that the participants' knowledge of how sounds are spelled in the language can and does affect performance on the phonological awareness tasks. The influence of orthographic representations of the phonemes on phonological awareness is examined in the phoneme deletion task.

Only the first phoneme was targeted in the phoneme deletion task. In some cases this phoneme was spelled with a single consonant (orthographically simple) and in some cases this phoneme was spelled with more than one consonant (orthographically complex).

As mentioned previously, Group 1 and Group 2 differed both on their accuracy in the phoneme deletion task, and the percentage of errors that were due to orthographic interference. Group 1 (M = 64.2, SD = 29.7) performs better on phoneme deletion than group 2 (M =17.1, SD = 26), and this difference persists into the abilities of each group to delete orthographically simple and complex sounds ($F(2, 49) = 17.19$, $p < .001$, *partial eta squared* = 0.41). Post hoc Fisher LSD analysis revealed that group 1 did markedly better than Group 2 on deleting both simple ($p < .001$) and complex ($p < .001$) represented sounds. The group means, as well as how many participants did not give a single correct response, are presented in Table 27.

Table 27. Group means for phoneme deletion by orthographic representation

Orthographic representation	**Group 1**			**Group 2**		
	M	***SD***	**Tally of 0 scores**	***M***	***SD***	**Tally of 0 scores**
Simple[a]	71.8	31.2	1	22.4	30.2	13
Complex[a]	51.9	35.3	6	10.6	23.6	20

[a]percentage

When sounds are represented by more than one letter, performance in phoneme deletion is reduced for both groups. Group 1 performed better when the sound was represented by one letter, as confirmed by a Sign test ($Z = 2.65$, $p = .008$). Group 2, even though they did poorly in general, also performed better when the sound was represented by a single letter ($Z = 8.33$, $p = .009$). This trend is confirmed by the number of participants who did not answer a single phoneme deletion stimulus correctly. Table 27 shows how the number of participants receiving 0 scores increases when complex represented sounds are manipulated.

Recall that the phoneme deletion task targeted only the initial phoneme, which should be a very easy task in a transparent orthography. In fact, in Group 1, the majority of participants perform above 70% on single letter sounds, and half of them perform above 70% in the multiple letters sounds. This finding suggests that the task may be too simple for learners who have developed sensitivity to phonemes. On the other hand, in Group 2, the majority of participants perform below 20% on both conditions. This suggests that for participants who do not have phoneme awareness, even deletion of the first sound is too difficult, and may indicate an underlying phonological processing disorder.

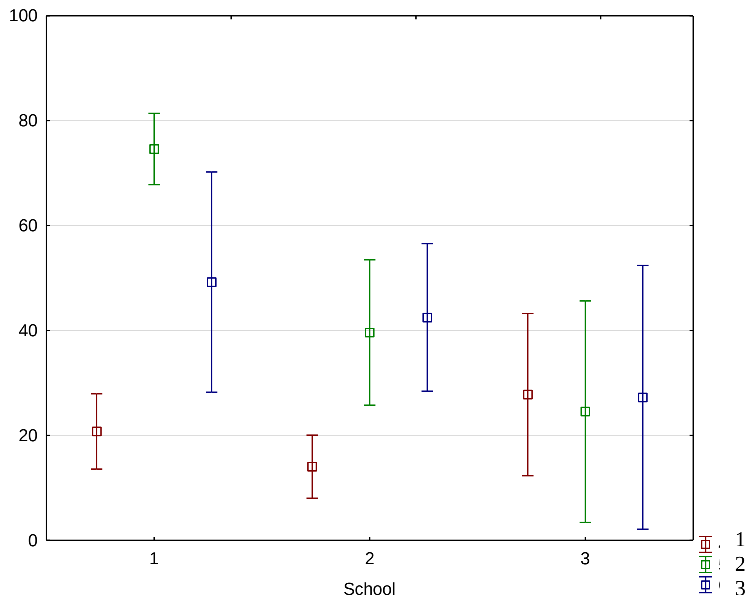
In summary, orthography clearly affects phonological representations where one-sound-one-letter units are easier to manipulate than sounds represented by more than one letter. Furthermore, this effect is uniform across learners with and without high levels of phonological awareness. This suggests that by Grade 3, these learners have built up orthographic representations of sounds in isiXhosa, and in responding to phonological awareness tasks, the orthographic representations affect results (Landerl *et al*. 1996). The recommendation for phonological awareness tests is to include sounds which are only represented by a single letter in order to eliminate the interference of orthography. However, as mentioned previously, sounds with orthographically complex representation were chosen for inclusion in the nonwords this study in order to determine their influence on phonological awareness responses.

4.5.9 Performance by school

Examination of the results by school confirms that performance on the phoneme tasks was affected by the school the participant is from Figure 20 (a). There is a trend that school 1 ($N = 13$) outperforms school 2 ($N = 28$) and school 3 ($N = 11$) but this reached significance only for the phoneme tasks. One interpretation of this difference in achievement between participants form the different schools is that they are a result of teaching environment, especially since the difference is only observed in the phoneme tasks.

A Kruskall-Wallis ANOVA showed that the participants from the schools did not differ on their syllable ($H(2, 52) = 1.88$, p =.39) manipulation abilities, but they did differ in their ability to manipulate phonemes ($H(2, 52) = 6.94$, $p = .03$), especially the identification of phonemes.

Figure 20 (b) shows that reading abilities do differ by school, especially in the learners' reading accuracy which relies most on phonological awareness.



Key

1 – phoneme segmenting

2 – phoneme identification

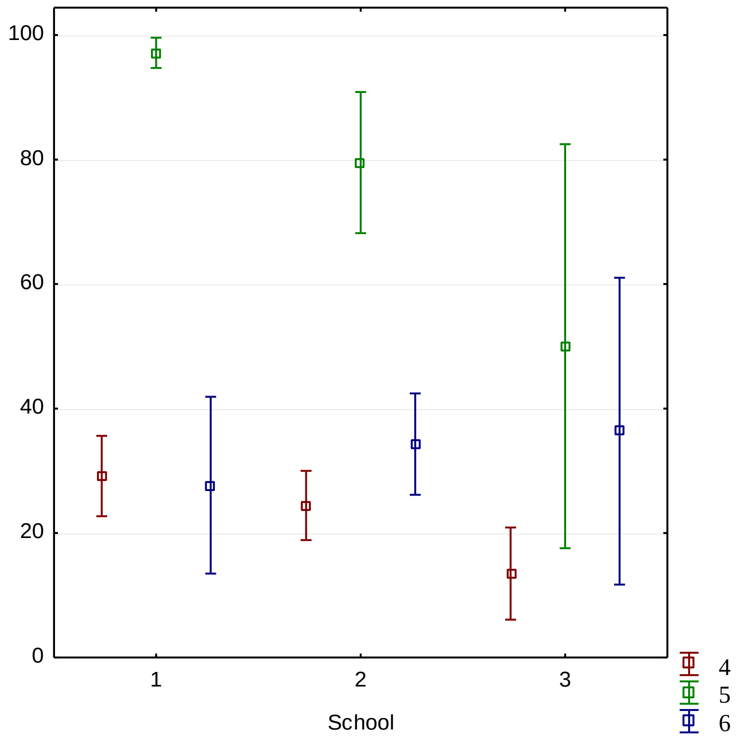
3 – phoneme deletion

4 – Reading Fluency

5 – Reading Accuracy

6 – Reading Comprehension

(a) Performance on phoneme tasks by school



(b) Performance on reading tasks by school

Figure 20. (a) and (b) Means plots of performance by school

This finding highlights the fact that phoneme awareness is influenced by print exposure and teaching methods. The data suggest that the teaching approach in school 1 focuses on the phoneme more so than the teaching in school 2 or 3, with school 3 with the least focus on phoneme approaches because of the differences in accuracy. On the other hand, there could be a number of other reasons why school 1 performs better. Since data was not collected on the quality of the school, the explanation cannot be definitive. Nevertheless, this finding is important in that the role of the school from which the participants is from must be accounted for in other studies. Secondly, if phoneme awareness abilities can differ by school, this means that teaching instruction can improve phoneme awareness abilities, as has been shown for English (Gillon 2004).

The difference in performance among schools does not affect the analysis of participants in the two sub-samples because the two subsamples have a comparable number of participants from each school. The chi squared statistic shows that the groups did not have significantly unequal number of participants from one school or the other, both in Group 1 (*Chi-square*(2) = .78, p = .68) and Group 2 (*Chi-square*(2) = 2.11, p = .35). This means that analysing each group (as determined by unit errors) as a whole is not problematic because the number of participants from each school is balanced in the two groups (Table 28).

Table 28. Observed and expected frequency of participants from each school in the sub-samples

	Number of participants – Group 1	Number of participants - Group 2	Total in whole sample	Expected frequency per group
School 1	9	4	13	6,5
School 2	13	15	28	14
School 3	4	7	11	5,5
Total	26	26	52	26

4.5.10 Summary: the influences on phonological awareness in isiXhosa

The results of the phonological awareness task were addressed in detail in order to answer Research Question 1 which asks:

1. What are the phonological awareness levels of Grade 3 isiXhosa readers/speakers?
    a. What linguistic aspects of isiXhosa, or other factors, affect phonological awareness in isiXhosa?
    b. How best can phonological awareness be measured in isiXhosa?

The tasks used in this study elicited a range of results, some of which were at ceiling and some at floor levels. There was better performance on the syllable tasks than the phoneme tasks. It was found that performance on phonological awareness tasks was affected by: the linguistic unit targeted, the task difficulty, orthographic interference, word length, position of the unit in the word and the school that the participant attends.

The large number of CV syllables in isiXhosa enables a high level of syllable awareness, which was seen in the accuracy scores for the syllable tasks. IsiXhosa participants do more poorly on phoneme tasks, where even an easy task like initial phoneme deletion was for the most part answered inaccurately. This finding was unexpected considering that the transparent way isiXhosa is written should fast track the development of phoneme awareness. The large performance gap between syllable and phoneme performance was explained with reference to teaching methods which probably do not focus on the phoneme as a unit for reading. This is not to say that participants do not develop orthographic representations of the sounds in isiXhosa. The high frequency of orthographic errors on the phoneme segmenting tasks, the decrease in performance on phoneme deletion when sounds were represented by digraphs, and the improved identification of the vowel in phoneme deletion, highlights the link between phonological awareness and reading. The morphology of isiXhosa may play a role in supplementing phonological awareness given that position of the unit was better for some units because this is where morphological changes take place in isiXhosa (at least for participants with high levels of phonological awareness). Furthermore, the limited set of vowels makes them easier to identify (for more sensitive participants). Performance by Group 2, who have lower levels of phonological awareness, are more affected by the load on working memory, clearly showing the effects in word length. Teaching methods at each school may also account for differing levels of phonological awareness highlighting that phoneme awareness can be improved with the appropriate teaching methods.

The tasks developed for this study worked well, as evidenced by an analysis of the errors produced on each task. It was found that phonological substitution errors were more common in the segmenting tasks, because of either a deficit in working memory (so that the correct sounds could not be recalled) or as a result of genuine slips of the tongue. The number of task errors and non-responses increased as task difficulty increased suggesting that there is a need to improve the instructions for some of the tasks. Consideration must be made to include more examples before the task starts and perhaps also include corrective feedback especially for the segmenting tasks which may have been interpreted incorrectly as a spelling task. Tasks which were affected by the length of the stimuli, such as the phoneme segmenting task, should also use shorter stimuli. The use of nonwords is recommended to avoid semantic interference. Likewise, only sounds which are spelled with one letter should be used in future in order to avoid orthographic interference.

A detailed analysis of PA in isiXhosa was provided because Ziegler and Goswami (2005) argue that an understanding of phonological awareness is essential for understanding literacy. The next section presents the descriptive statistics for Group 1 and Group 2. This leads into an examination of the relationships between variables in this study, with a specific focus on the relationship between the phonological awareness tasks and naming speed, in order to determine whether they should be included separately in the multiple regression reported in §4.8.

4.6 Group characteristics

The whole sample was split into two groups in order to overcome the bimodal distribution in the Deletion scores. The two groups differ significantly in their ability to manipulate phonemes. What is not known is how the groups differ on any of the other variables. The descriptive statistics for the whole sample and the two smaller samples are presented in Table 29.

The data fulfilled the requirements of a normal distribution for all the measures, except Accuracy, that will be used for later analyses. There is a trend that group 1 performs better on every measure. Group 1 is also younger. A one way ANOVA indicated that the subsamples differed significantly on at least some of the measures, ($F(7,41) = 9,73$, $p < .001$, partial $\eta^{2} =$ 0.62). Post hoc Fisher LSD analysis revealed that the groups differed on Identification ($p < .001$), Deletion (p < .001), and Naming Speed (p < .001), but all other scores were equivalent.

It is quite unexpected that the two groups do not differ significantly on any of the dependent variables, especially considering that the groups differ on both independent variables, with group 1 having both better Naming Speed and Deletion scores. The theory about phonological awareness and naming speed covered in Chapter 2 predicts that groups with lower phonological awareness and naming speed should do worse on both Fluency and Comprehension. However, in the current study on isiXhosa, the group with lower phonological awareness and naming speed do not read significantly fewer words, nor understand less nor read with lower accuracy. It must be noted that splitting the larger sample resulted in two smaller groups of 26 participants, thereby increasing the chance of a type II error (Button *et al.* 2013). Future studies should compare performance in a larger sample. The finding that Group 1 and 2 do not differ significantly on the dependent variables could also suggest that other factors contribute to whether a learner can read or understand the text. Other factors include vocabulary, morphological awareness, print exposure, phonological working memory, familiarity with the story, etc.

Table 29. Descriptive statistics of all groups

	Whole sample		Group 1		Group 2	
Variable/Task	**Mean**	**(SD)**	**Mean**	**(SD)**	**Mean**	**(SD)**
Age[a]	10;8	(1)	9;10	(1)	10;3	(1)
PA Task[b]						
Segmenting[b]	**53**	**(11.2)**	**53.4**	**12.8**	**52.7**	**9.7**
Syllables[b]	*87.4*	*(16.8)*	*86.5*	*13.5*	*88.4*	*19.7*
Phonemes[b]	*18.6*	*(17.2)*	*20.3*	*18.1*	*17.0*	*16.5*
Identification[b]	**56**	**(24.9)**	**66.5**	**22.6**	**45.4**	**22.9**
Syllables[b]	*66.7*	*(30.5)*	*73.5*	*31.2*	*60.0*	*28.1*
Phonemes[b]	*45.2*	*(35.1)*	*59.6*	*32.3*	*30.8*	*32.1*
Deletion[b]	**46.5**	**(29.5)**	**66.7**	**24.8**	**26.2**	**17.5**
Syllables[b]	*51.9*	*(28.5)*	*69.2*	*24.8*	*34.7*	*20.4*
Phonemes[b]	*41*	*(36.3)*	*64.2*	*29.7*	*17.7*	*26.0*
RAN Digits[c]	**0.76**	**(0.34)**	**0.93**	**0.32**	**0.59**	**0.26**
Oral Reading Task						
Words correct per minute[c]	19.4	(12.8)	22.5	11.0	16.2	14.0
Accuracy[b]	77.7	(34.3)	88.8	21.2	66.6	41.1
ORF Comprehension[b]	23.9	(26.9)	30.0	29.5	17.7	22.9
Silent Reading Task						
Words attempted in one minute[b]	27.3	(15.5)	30.3	13.4	24.2	17.0
SRF Comprehension[b]	42.3	(29.3)	49.2	27.9	35.4	29.6
Composite Comprehension[b]	*23.3*	*(25.3)*	39.6	26.3	26.5	22.8
Composite Reading[c]	*33.1*	*(13.8)*	26.4	11.8	20.2	15.1

Leinonen *et al*. (2001) examined the characteristics of adult dyslexia in Finnish, identifying different groups who differed in their reading fluency and accuracy, which reflected deficits in naming speed and phonological awareness. They found that readers can overcome earlier deficits in PA or NS or any form of "cognitive processing" and "spontaneously develop reading strategies that do not rely on, or at least minimize the use of those affected types of cognitive processes." (Leinonen *et al*. 2001: 290). The same could be said for readers in Group 2 who overcome deficits in PA and NS with other methods.

The correlational and multiple regression analyses may shed more light on this finding in this Grade 3 sample of readers.

4.7 Correlational analysis – answering research question 2

Correlational analyses were run for the whole sample and each smaller group in order to determine the relationships between the variables. Before a multiple regression can be run, it is important to establish that the independent variables are not collinear, and that they have a linear relationship with the dependent variables (Osborne & Waters 2002).

A Spearman correlation was run for the whole sample because of the non-normal distribution in Identification and Deletion (Table 30). Pearson correlations are reported for Group 1 (Table 31) and Group 2 (Table 32). The strength of linear relationship between the phonological awareness tasks and naming speed is important for answering research question 2 and determining collinearity. Research question 2 asks:

2. What is the relationship between phonological awareness and naming speed in isiXhosa?

Table 30. Spearman correlations for the whole sample

	1.	2.	3.	4.	5.	6.
1. Segmenting Score	-					
2. Identification Score	.24	-				
3. Deletion Score	.32*	.61***	-			
4. RAN items/s	-.17	.36**	.47***	-		
5. Reading Fluency	.19	.43**	.50***	.41**	-	
6. Oral reading accuracy	.27*	.51***	.48***	.20	.75***	-
7. Comprehension	.25	.23	.44***	.41**	.69***	.40**

*p<.05 **p<.01 ***p<.001

Table 31. Pearson correlations for Group 1

	1.	2.	3.	4.	5.	6.	7.
1. Segmenting Score	-	-.04	.37	-.32	.33	.25	.21
2. Identification Score	.18	-	-.03	.17	.08	.15	.18
3. Deletion Score	.57**	.32	-	.15	.17	.43*	.39
4. RAN items/s	-.23	.19	.16	-	-.22	.00	.05
5. Reading Fluency	.37	.31	.38	-.01	-	.58**	.56**
6. Oral reading accuracy	.26	.45*	.51**	.31	.66***	-	.27
7. Comprehension	.41*	.25	.49*	.16	.57**	.37	-

*p<.05 **p<.01 ***p<.001 (Correlations above the diagonal are controlled for age)

Table 32. Pearson correlations for Group 2

	1.	2.	3.	4.	5.	6.	7.
1. Segmenting Score	-	.33	.22	-.09	-.02	.27	-.15
2. Identification Score	.32	-	.62**	.21	.45*	.42*	-.07
3. Deletion Score	.22	.63**	-	.18	.44*	.48*	.12
4. RAN items/s	-.09	.21	.18	-	.65***	.40*	.38
5. Reading Fluency	-.01	.46*	.45*	.65***	-	.78***	.65***
6. Oral reading accuracy	.27	.47*	.51**	.40*	.78***	-	.55**
7. Comprehension	-.14	-.01	.15	.38	.65***	.57**	-

*p<.05 **p<.01 ***p<.001 (Correlations above the diagonal are controlled for age)

The question is needed in order to establish whether NS and PA should be included as one construct in the multiple regression, or as two constructs. This question is needed because of the conceptual debate about whether NS forms part of phonological processing or should be considered as another construct. If these variables form independent constructs, then they should be treated separately in further analysis. However, if these two variables are two measures of the same construct, then they should be combined into a composite score for later analysis. Evidence to tease out this relationship comes from a correlational analysis, and from the multiple regression. If the PA and NS tasks have a strong relationship this suggests they may measure the same construct. On the other hand, if they are weakly related, this is evidence that NS may not only be phonological (Wolf *et al*. 2000). Furthermore, if in the multiple regression NS accounts for unique variance after controlling for PA, and contributes to different variables, this suggests that NS and PA are separate constructs (strong version) (Norton & Wolf 2012) or that NS is not only phonological in nature (weak version). Given that only one measure of NS was used in this study, conclusions can only be tentative.

Tables 30 – 32 show that the relationship between NS and the PA tasks is stronger for the whole sample than for either of the two groups. In the whole sample, the strength of the relationship between NS and the PA tasks is very weak to moderate, becoming significant only for Identification ($r_{(S)}$ = .36, p < .01) and Deletion ($r_{(S)}$ = .47, p < .001). At the same time, the relationships between PA tasks are stronger with a moderate to strong relationship between Identification and Deletion ($r_{(S)}$ = .61, p < .001). Wolf and Bowers (1999) reviewed a number of studies on the relationship between Deletion and NS. They report that similar moderate correlations have been found between Deletion and NS in groups unselected for their reading ability. A moderate correlation was also found in meta-analyses (Swanson *et al*. 2003, Melby-Lervag *et al*. 2012). Of course, the reported studies used Pearson correlations, but my study, using a Spearman correlation, shows that the trend is that NS and PA (Identification and

Deletion) have a moderate monotonic (not necessarily linear) relationship in the sample unselected for reading ability (Figure 21).

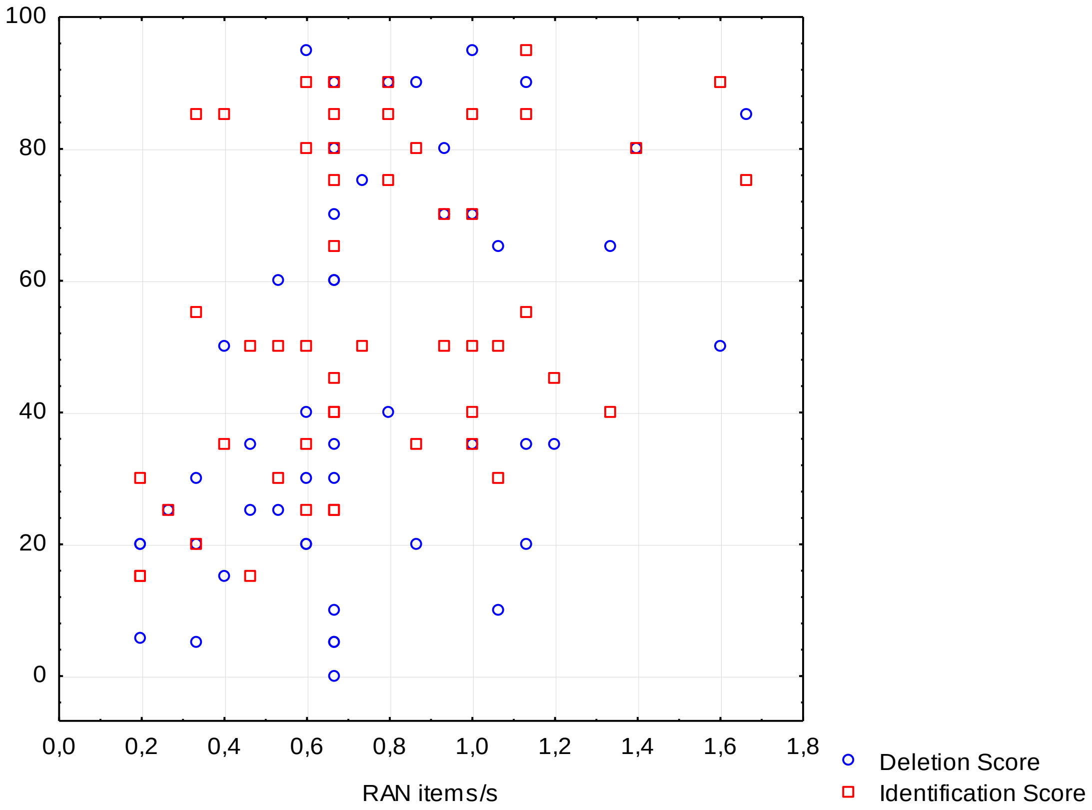


Figure 21. Scatterplot of Identification, Deletion and Naming Speed

Pearson correlations for Groups 1 and 2 shows that there is no significant linear relationships between NS and any of the PA tasks, before and after age has been controlled for. Wolf and Bowers (1999) also report that for samples which have been selected for a certain characteristic, there were lower reported correlations between PA and NS. The explanation for this is that NS is a construct that develops along an asymptotic curve i.e. it is steep in the beginning, and then flattens out towards the end. In my study Group 1 has both higher PA and NS levels, which means both measures are flattening out, decreasing the relationship. For Group 1, PA levels are generally quite low, and so is their NS, thereby decreasing the relationship between the two.

At this stage, it appears that NS and PA do share some variance (especially in the whole sample). The finding that they do not have a linear relationship in Group 1 and Group 2, suggests that NS and PA should be included separately in the multiple regression in this study. Note that determining a conceptual definition for NS is out of the scope of the thesis. I only seek to describe the trends found in the data.

4.7.1 Relationships to the dependent variables

A multiple regression rests on the assumption that a linear relationship exists between the independent variables (in this case Deletion and Naming Speed) and dependent variables (reading Fluency, Accuracy and Comprehension) (Osborne & Waters 2002). The fact that Deletion has a stronger relationship with Identification provides more evidence for using only one of the phonological awareness measures in the multiple regression analyses. Since Deletion also has stronger correlations with the dependent variables only Deletion is used in the multiple regression analyses. Significant correlations among the independent and dependent variables are marked in Table 33.

Table 33. Linear relationship of PA and NS to dependent variables

	Fluency	**Accuracy**	**Comprehension**
Deletion			
Whole Sample	x	x	
Group 1		x	(x) (non-significant when age is controlled for)
Group 2	x	x	
Naming Speed			
Whole Sample	x		x
Group 1			
Group 2	x	x	

Table 33 shows that PA has a relationship to accuracy, for all groups, and to fluency for the whole sample and Group 2. NS has a relationship to reading fluency and accuracy for Group 2 and fluency and comprehension for the whole sample. NS does not have a linear relationship with any of the dependent variables for Group 1. This is probably because Group 1 has reached ceiling level in NS. The relationships shows that use of a multiple regression for Comprehension may be ill advised because of the lack of a linear relationship to it in some of the samples. Interestingly, it seems that Group 2 makes use of Deletion and Naming Speed for both reading fluency and accuracy. Results from the multiple regression can tease out this relationship more.

4.7.2 Summary

Evidence from the correlations for the whole sample and for each group suggests that NS may not only be phonological in nature. The correlations for the whole sample are only moderate, and when the whole sample is split into the two groups, there is no significant linear relationship between NS and PA. Furthermore, there are higher correlations between the PA tasks than with the NS task. Finally, although to be confirmed by the multiple regressions, NS is related to different variables than PA. NS has relationships with fluency and comprehension whereas as PA is implicated the most in reading accuracy.

4.8 The roles of phonological awareness and naming speed to reading fluency, accuracy and comprehension and spelling – answering research question 3

In this last section of Chapter 4, the third research question is answered by running a series of forward stepwise regressions for each dependent variable in each sample. Research Question 3 asks:

3. What is the contribution of phonological awareness and naming speed to reading fluency, accuracy, comprehension and spelling in isiXhosa?
    a. How do these findings relate to the predictions of current reading theories?
    b. Based on 3a, do adaptations need to be made to PGST's conceptualisation of reading?

4.8.1 Summary of the relevant literature and results

In Chapter 2 it was noted that PA has been shown to be a good predictor of reading accuracy, and comprehension, while NS has a larger role to play in reading fluency, as well as comprehension, because of its link to speed components. It can be expected then that similar independent contributions should be found in my sample.

It was also noted in Chapter 2 that in a transparent orthography, such as that for isiXhosa, both PA and reading accuracy reach high levels early on in reading instruction. This results in the lack of correlation between the two because of ceiling effects. Ceiling effects were avoided in the phonological awareness results by using a range of tasks which differ in their difficulty, thereby eliciting variation. For the whole sample the results for Deletion and Identification were bimodally distributed indicating that some participants were able to do the tasks, and that some were not able to do the tasks. This warranted the splitting of the sample into the two groups according to the errors made. Those participants who could not easily distinguish between when a syllable or phoneme was targeted were split into group 2, and group 1 contains those participants who could easily tell which unit to target. This resulted in normal distributions for Deletion for each sub-group. With reference to reading accuracy, most scores are high, but there are some participants who do not reach high levels of accuracy. Transformation of the accuracy data did not improve normality so the raw scores are used, with the acknowledgement that the assumption of normality is violated.

As yet, the research has not reached consensus on the role of NS to reading in unselected populations i.e. populations which are not selected for reading disability. However, the research shows that the contributions of NS to reading in unselected populations is lower than for readers selected for reading disability (Wolf & Bowers 1999).

With this relevant literature in mind, the contributions of PA and NS to reading fluency, accuracy and comprehension in these samples of Grade 3 isiXhosa readers are determined through running a forward stepwise multiple regression in order to find out the best sub-set of variables. A forward stepwise regression eliminates variables which become “redundant through the subsequent inclusion of other variables into the regression equation” (Thompson 1978: 11). Thus, if NS is subsumed under phonological processing we could expect that PA is the only significant predictor. Use of a stepwise regression also prevents the inclusion of two variables when one is enough to account for the variance. The rule of thumb for sample size when performing a regression is that there should be 10 observations for every predictor variable (Maxwell 2000). There are two independent or predictor variables (phonological awareness and naming speed) and three dependent or outcome variables (reading Fluency, Accuracy and Comprehension). In this case, I need at least 20 observations to perform the regression. The sample size is met for both the whole sample (N = 52) and the two sub-samples (N = 26).

At this point it is also important to point out that the correlations between the variables in the two sub-groups differ, with the second group showing stronger relationships between the independent variables and the dependent reading variables. Thus, for group 1, the multiple regression may not return significant contributions because of the lack of a linear relationship (Osborne & Waters 2002) between the dependent and independent variables. This is addressed in more detail in the sections below.

A series of forward stepwise regressions was run for the entire sample of 52 participants, Group 1 (N = 26) who has higher levels of PA and NS than Group 2, and Group 2 (N = 26). The contributions of PA and NS to reading fluency, accuracy and comprehension are reported for each group. The contributions of NS and PA can be evaluated by examining how much variance they explain in the dependent variable in total, and how much variance they explain compared to each other. The findings are compared to what is found in the literature, and finally recommendations for the adaptation to PGST is addressed.

4.8.2 Contributions to reading fluency

The results of the forward stepwise regression are reported in Table 34. According to the literature reviewed in Chapter 2, NS would be the best predictor of reading fluency firstly because NS has consistently been shown to predict reading speed, and secondly because it may exert more influence in a transparent orthography. The data from my study provide conflicting results because there appears to be different patterns of the predictors according to the sample examined.

Table 34. Contributions of phonological awareness and naming speed to reading fluency

	Whole Sample		Group 1		Group 2	
	R^2	ΔR^2	R^2	ΔR^2	R^2	ΔR^2
Naming Speed	-	-	.06	.06	.42***	.42
Phonological Awareness	.18*	.18	.12	.06	.53*	.11
(Naming Speed)	.21	.03	-	-	-	-

*p<.05 **p<.01 ***p<.001

When looking at the unselected sample which contains all participants, the best predictor of reading fluency is PA, which accounts for 18% of the variance. NS explains a non-significant 3% of the variance when phonological awareness is taken into account. However, in a regression when considered in isolation, NS accounts for 14% of the variance. It is unexpected that for the whole sample NS does not become a significant predictor of reading fluency while PA is. This can be explained with reference to the large number of participants in the whole sample who have not reached sensitivity to phonemes. Readers who have lower levels of PA take longer to recognise words because their letter-sound correspondences are less well developed than participants with higher levels of PA (Ashby *et al*. 2013). For this reason, PA is the biggest predictor of reading fluency for the whole sample.

For Group 1, neither variable accounts for significant variance in isiXhosa reading fluency. This finding provides evidence that Group 1 consists of 'normally' developing (also known as an unselected sample of) readers of a transparent orthography. This is because PA reaches high levels of performance in 'normal' readers of a transparent orthography. With regards to NS the construct has shown to develop along an asymptotic trajectory. The NS of 'normal' readers has therefore reached its highest level and ceases to predict reading fluency.

Moll *et al*. (2014) studied 'normally' developing readers of Grade 2 - 5 Finnish readers among other languages. For Finnish, a very transparent orthography, NS and PA accounted for a small but equal amount of variance (3%) in reading fluency after controlling for age, IQ, and phonological working memory. This finding is very similar to that found in the Group 1 isiXhosa readers. Perhaps if the sample had been larger in this study then the contributions would have reached significance. The relatively larger contributions of both PA and NS found in isiXhosa can be attributed to the fact that it is not as transparent as Finnish.

The contributions of NS and PA in Group 2 exhibit patterns that support the classification of Group 2 as consisting of readers with reading difficulties according to the Double Deficit Hypothesis of reading. In Group 2, NS accounts for a large 42% of the variance in reading fluency and phonological awareness explains a further 11%. This finding corroborates other studies which have shown that NS is most related to reading speed. The fact that PA accounts for 11% variance in reading fluency after NS has been accounted for indicates again that readers with poor levels of PA take longer to recognise words because of the less well-developed understanding of letter-sound correspondences. There is also data to support that the readers in Group 2 have deficits in PA. Recall that participants were allocated to this group if they made many errors selecting which unit to target. This indicates that participants in this group could not easily tell the difference between syllables and phonemes, indicating a lack of awareness which is necessary for successful reading. The results of this regression explain why the inaccurate readers presented in Figure 6, page 96, are also slow. This is because they may have deficits in both NS and PA. The evidence so far seems to show that both low levels of NS and PA contribute to lower levels of reading fluency.

In conclusion, the role of PA and NS to reading fluency in isiXhosa depends very much on the characteristics of the sample; a similar finding is described in Wolf and Bowers (1999). In Group 1, which can be classified as an unselected sample, the roles of NS and PA are equal, which is a similar finding to that of Finnish reported in Moll *et al*. (2014). A larger sample may have returned a significant, although small, contribution of both NS and PA. In Group 2, which probably has PA deficits, NS was unequivocally the best predictor, but PA also contributed a fair amount of variance. The results for the whole sample show that PA is important for reading in isiXhosa.

The data show that PA predicts reading fluency in isiXhosa because of its link to speed of recognising words through phonological recoding. However, for readers with lower levels of NS and PA, NS is the better predictor by far. For readers with both good levels of PA and NS, neither predict reading fluency probably as a consequence of using vocabulary or morphological awareness. More research is needed on both average and poor readers of isiXhosa at different grade levels to establish whether these are stable relationships or only reflective of this specific sample. The fact that these findings mirror those reported in the literature suggests that the relationship to reading fluency is a stable relationship.

4.8.3 Contributions to oral reading accuracy

Forward stepwise regressions were run for each sample to determine the contributions of PA and NS to reading accuracy in the oral reading measure. The data for Accuracy was negatively skewed. Transformations did not improve normality so the raw Accuracy score is used in the regression. The violation of normaility is acknowledged. The results of the regression for each sample are reported in Table 35.

Table 35. Contributions of phonological awareness and naming speed to reading accuracy

	Whole Sample		Group 1		Group 2	
	R^2	ΔR^2	R^2	ΔR^2	R^2	ΔR^2
Phonological Awareness	.29***	.29	.25*	.25	.26**	.26
Naming Speed	.33	.04	-	-	.35	.09

*p<.05 **p<.01 ***p<.001

Research shows that PA is a better predictor or has a larger role to play in reading accuracy because of its use in orthography-phonology correspondences. The data in this study confirm this finding indisputably. PA contributes 29% in the larger sample, 25% in Group 1 and 26% in Group 2 to reading accuracy. NS also did not become a significant contributor. PA as measured by the deletion of syllables and phonemes contributes to text reading accuracy because phonological awareness is needed to develop orthography-phonology correspondences. Which size orthography-phonology correspondences, or grain sizes, isiXhosa readers use in text reading has not been definitively determined, but a regression run with both syllable and phoneme deletion as separate constructs allows for some insight. For Finnish, the contribution of NS to word reading accuracy was non-significant and small (0.3% of the variance), similar to that found in the whole sample in my study. The results of these regression analyses are reported in Table 36 and Table 37.

Table 36. Contributions of syllable deletion and naming speed to reading accuracy

	Whole Sample		Group 1		Group 2	
	R^2	ΔR^2	R^2	ΔR^2	R^2	ΔR^2
Syllable Deletion	.31***	.31	.29**	.29	.25**	.25
Naming Speed	.35	.04	-	-	.39*	.14

*p<.05 **p<.01 ***p<.001

The regressions run with syllable deletion show that syllable deletion accounts for slightly greater variance in reading accuracy for the whole sample (increase of 2%), and Group 1 (increase of 4%), and a 1% decrease in Group 2 than the composite Deletion score. The fact that syllable deletion accounts for more variance than a combined Deletion score provides evidence that isiXhosa readers may rely on the syllable as a grain size in reading, or at least that a reliance on the syllable as a grain size leads to accurate reading. The second interpretation is that use of syllable based reading instruction has made the syllable levels of PA a slightly better predictor of overall reading ability (Moll *et al*. 2009)

For Group 2, NS also predicts 14% added variance in reading accuracy when using syllable deletion as the PA variable. This may be explained if NS is understood to measure the speed of orthography-phonology correspondences. For the group with poor phonological skills (Group 2) naming speed predicts accuracy (after accounting for PA) because the speed of the orthography-phonology correspondences may be quite slow. While PA is needed to identify the correct sound for the letter, NS could be an indicator of matching the orthography at the letter level to the sound (Moll *et al*. 2009).

Table 37. Contributions of phoneme deletion and naming speed to reading accuracy

	Whole Sample		Group 1		Group 2	
	R^2	ΔR^2	R^2	ΔR^2	R^2	ΔR^2
Phoneme Deletion	.19***	.19	.16*	.16	-	-
Naming Speed	.27*	.08	.25	.09	.15*	.15
Phoneme Deletion					.20	.05

*p<.05 **p<.01 ***p<.001

Table 37 shows that when only phoneme deletion is added as a predictor variable it accounts for less variance than either syllable deletion or the composite deletion score, and in the case of Group 2 becomes a non-significant predictor. Phoneme deletion was a very easy task which targeted deletion of only the first phoneme. Since Group 2 performed very poorly on this task, only NS is a good predictor of reading accuracy.

In summary, the data show that PA is the better predictor of reading accuracy, compared to NS. However, different PA measures predict accuracy differently. The biggest contribution was made by syllable deletion only, which contributed slightly more variance than the composite Deletion score. This suggests that isiXhosa readers use the syllable as a grain size in order to read accurately, which may reflect reading instruction where readers are taught letter-sound correspondences through syllables where the same consonant is matched with all five vowels e.g. *ba, be, bi, bo, bu*. Phoneme deletion predicted less variance, and did not reach significance in Group 2. There is also a trend that NS plays a role in text reading accuracy which was most pronounced in Group 2. A suggestion was made that the role of NS in Group 2's accuracy could be explained by the definition of NS as measuring the speed of orthography-phonology correspondences at the letter and letter cluster level.

4.8.4 Contributions to reading comprehension

The results of the correlational analysis in §4.7 showed that PA and NS did not have strong or significant relationships to comprehension. Since a multiple regression relies on the existence of a linear relationship in the independent variables, this assumption is violated when the regression is run with comprehension as the dependent variable. The lack of significant relationships with comprehension could be due to the task consisting of only 5 questions for each mode. Future studies should include more items in order to improve reliability and validity. Once again, regressions were run to determine the role of NS and PA to reading comprehension, but because of the lack of relationship to Comprehension the regression is run only to see if there are trends that could be explored further in later research. The results of this regression are reported in Table 38.

The literature reviewed in Chapter 2 highlighted that both NS and PA are related to reading comprehension: PA for its role in accuracy and NS for its role in reading speed. The data from isiXhosa show that only PA is implicated in reading comprehension for the whole sample (18%) and Group 1 (20%), probably because of its role in reading accuracy. NS plays a non-significant role in the whole sample and Group 2, and no role at all in Group 1.

Table 38. Contributions of phonological awareness and naming speed to reading comprehension

	Whole Sample		Group 1		Group 2	
	R^2	ΔR^2	R^2	ΔR^2	R^2	ΔR^2
Phonological Awareness	.18**	.18	.20 *	.20	-	-
Naming Speed	.21	.03	-	-	.15	.15

*p<.05 **p<.01 ***p<.001

4.8.5 Contributions to spelling

Fourteen participants were administered a 15 stimuli nonword spelling test which were words taken from the phonological awareness tasks. The descriptive statistics are provided for this sub-sample in Table 39.

Table 39. Descriptive statistics for Spelling sub-sample

	M (*N* = 14)	**SD**
Phoneme Segmenting	24.3	13.4
Phoneme Identification	63.6	29.0
Phoneme Deletion	44.3	37.4
Naming Speed	0.72	0.27
Fluency	28.4	10.5
Accuracy	90.9	26.3
Comprehension	31.0	22.7
Spelling	12.4	2.5

A forward stepwise regression was run with all PA measures and NS as predictor variables. The forward stepwise regression showed that together phoneme identification and phoneme segmenting account for 50% of the variance in spelling (Table 40). This finding again confirms that performance on the segmenting and identification tasks are influenced by orthographic knowledge. Furthermore, spelling in isiXhosa is also influenced by PA levels. The data also suggest that NS is probably not a measure of orthographic processing because it did not explain any variance in this small sample of spellers (Moll *et al*. 2009). This can be confirmed or refuted by replicating the spelling task with more participants.

Table 40. Contributions to spelling

	R^2	ΔR^2
Phoneme Identification	.33*	.33
Phoneme Segmenting	.50	.17

*p<.05

4.8.6 Meeting the predictions of the Psycholinguistic Grain Size Theory

The Psycholinguistic Grain Size Theory emphasises the role of PA for phonological recoding at the different grain sizes. This study did not attempt to determine the exact grain size that isiXhosa readers use. In order to do this, a carefully controlled word list experiment should be conducted. Rather, the scope of this thesis was to examine the relative contributions of PA and NS to reading fluency, accuracy, comprehension and spelling in isiXhosa.

One of the goals of the study was to determine whether similar findings were made in isiXhosa as in other languages which are also written transparently. Furthermore, another goal was to determine if PA was a good predictor of various reading abilities in isiXhosa, as the PGST suggests. Finally, the role of NS was explored. PGST does not explicitly and adequately address the role of NS and how it is involved in using grains of various sizes in reading. The NS data may point the way to where this could be included.

PGST explains the acquisition of reading accuracy: readers match the available sound units in their language to the orthographic units that are most frequent and regular in the written form of their language to develop grains of different sizes used in reading. Wimmer (2006) praises the PGST for its detailed explanation of the acquisition of reading accuracy, but criticises the theory for neglecting to explain how reading fluency is attained, citing the role of NS in attaining reading fluency. In some studies which use PGST as their theoretical foundation, they cite that efficient use of phonological recoding at different grain sizes leads to fluency in reading. Given the evidence that NS is involved in reading fluency, it is strange to find that PGST does not explain how NS leads to fluency from a PGST perspective. As yet, there is inconclusive evidence of the underlying construct that NS measures which makes it difficult to explain how NS may be involved in developing reading strategies at different grain sizes. The lack of certainty about what NS measures is in stark contrast to the well-established research on the underlying construct of PA.

The results of my study confirm that PA is a very important psycholinguistic skill which is needed for reading accuracy, comprehension, spelling and fluency for reading isiXhosa which is relatively transparently written, and for a sample quite far in literacy instruction (Grade 3). This confirms the predictions of the Psycholinguistic Grain Size Theory, that phonological recoding is important for each reading process. To note is that in Group 1, reading fluency was predicted by neither PA nor NS, emphasising that better readers rely on different reading strategies, perhaps using vocabulary and contextual factors to enhance their reading fluency.

What the Psycholinguistic Grain Size Theory did not predict is that in the group with lower levels of PA (Group 2), NS predicted much more variance in fluency. NS also explained an added 14% of reading accuracy after accounting for syllable deletion ability. This shows that NS (digit naming) can be a good predictor, at least in groups with lower levels of PA and NS. In my study, Group 1 and Group 2 did not differ significantly on reading fluency or comprehension, perhaps because Group 2 has developed alternative reading strategies for reading to overcome their lower levels of both PA and NS. Group 2 has lower levels of both PA and NS yet read almost as fast and accurately as Group 1. Further research is needed to establish what the alternative reading strategy would be. Since Group 2 exhibit fewer orthographic errors on the PA tasks, it could be postulated that a small grapheme-phoneme grain size is not being used efficiently by Group 2.

Data from the correlational analysis and from the regression analyses suggest that NS may not only be phonological in nature. NS showed moderate correlations with the PA tasks, which did not reach significance in the smaller samples. Furthermore, NS explained variance significantly only for reading fluency. Since it explains different variables to PA, this is evidence that PA and NS may not be the same contruct. Since NS is not only phonological, and neither is it only orthographic (it predicted no variance in spelling) perhaps it measures the "automaticity of orthography to phonology associations at the letter and letter cluster level". (Moll *et al*. 2009: 22) (Figure 22). Data from my study cannot be used to confirm or disprove that this is the case. The theoretical interpretation of NS provided by Moll *et al* (2009) nevertheless does fit well in the PGST. PGST needs to explain how NS is involved in reading because NS has been shown to explain reading even after accounting for PA.

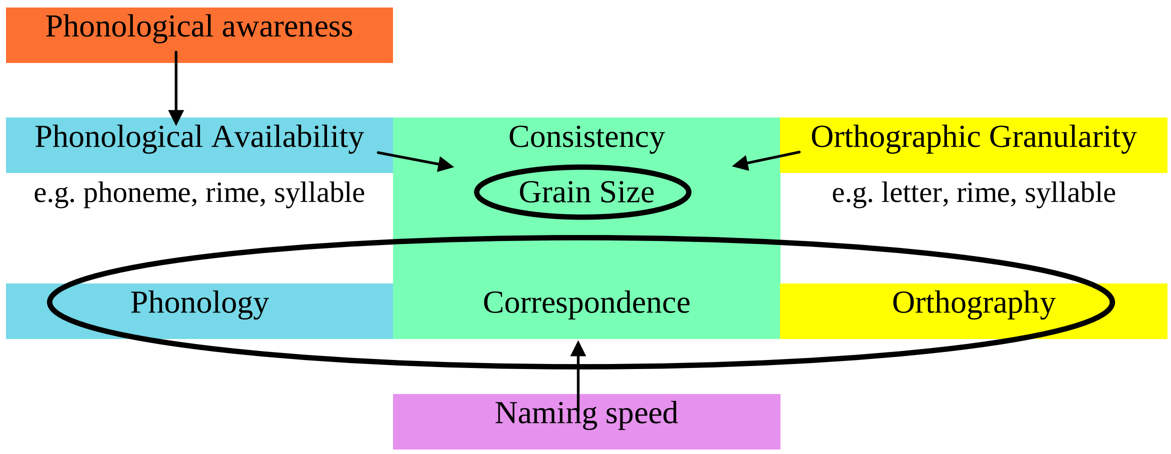


Figure 22. The proposed roles of phonological awareness and naming speed in using different grain sizes

I return to the schematic diagram first presented in Chapter 2, reproduced above as Figure 22. PA is used at the 'availability' level for reading (identified in blue). Readers need to be sensitive to the sound structure of their language in order to make use of the alphabetic principle – that letters on the page represent sounds in the language. PA is also essential to establish letter-sound correspondences (Ashby *et al*. 2013). Readers learn about the orthography of their language by developing their letter knowledge, and through teaching instruction. It is at the level of the correspondence between orthography and phonology where NS could be included in PGST (in green). This interpretation is different from the conception of NS as speed of lexical access, which implies retrieval of whole lexical items. Rather I suggest that NS may measure the speed of matching an orthographic grain (of the letter or letter cluster size) with its phonological grain (at the syllable or phoneme size) at the sub-lexical level. Of course, these are cautious interpretations, but future PGST studies could devise ways of explicating the role of NS in developing and using grains of different sizes. My interpretation also straddles the line between an understanding of NS related to reading as phonological and orthographic in nature.

If NS measures the "automaticity of orthography to phonology associations at the letter and letter cluster level" (Moll *et al*. 2009: 22) this could explain why it predicts more variance in Group 2's reading fluency than phonological awareness. Because Group 2's PA levels are lower, it can be deduced that they have a less well-developed understanding of grapheme-phoneme correspondences. Thus, as well as being inaccurate in their identification of the sound, they are also much slower in retrieving the phonological pronunciation of the letter string. This is especially problematic for reading fluency where these correspondences must be made quickly enough to allow cognitive resources to retrieve the lexical item for comprehension. NS plays a non-significant role in spelling, because the task does not require the speeded access to these representations.

4.9 Conclusion

Thus, it seems to be the case that for the most part, the PGST successfully explains the role of PA in reading fluency, accuracy, comprehension and spelling in isiXhosa. All the variables rely on PA, stressing the importance of this variable for successful reading. However, in the case of Group 2, NS becomes an important predictor and actually predicts more variance than that of phonological awareness. This suggests that for some readers (those on the lower end) NS is an important variable that needs to be considered in PGST so that it can continue to purport to explain all types of reading.

PGST refers to the role of NS as a component of phonological processing. The results of my study show that although PA and NS are weakly to moderately correlated, they explain unique variance in the reading variables, and have differing relationships with these variables, and for different groups. PGST can only viably explain the role of NS in reading once the reading field reaches a consensus on what exactly NS is a measure of. One such interpretation which could fit in quite well with PGST is that of Moll *et al*. (2009: 22) that naming speed measures the "automaticity of orthography to phonology associations at the letter and letter cluster level". More research is clearly warranted on the role of NS to reading within the PGST framework.

5 CONCLUSIONS

5.1 Introduction

In this thesis, the roles of phonological awareness and naming speed to reading fluency, accuracy, comprehension and spelling abilities of Grade 3 isiXhosa readers was examined. This research seeks to provide a foundation for future enquiry into the micro-linguistic aspects of isiXhosa literacy. Because there is not much research on these micro-linguistics aspects my study also has many lessons to offer on choices made in the methodology. Furthermore, the enquiry of the psycholinguistic and cognitive skills necessary for reading in isiXhosa can inform pedagogic practice in South Africa.

Chapter 5 provides a summary of the findings of this study. It also addresses the implications of these findings for method, theory and pedagogy in South Africa. Finally, many recommendations are made for future researchers because this was the first study in my knowledge to examine both phonological awareness and naming speed in isiXhosa.

5.2 Summary of main findings

5.2.1 Phonological awareness in isiXhosa

The results of the phonological awareness task were analysed in §4.5 in order to answer the first research question.

1. What are the phonological awareness levels of Grade 3 isiXhosa readers/speakers?
    a. What linguistic aspects of isiXhosa, or other factors, affect phonological awareness in isiXhosa?
    b. How best can phonological awareness be measured in isiXhosa?

The participants in this study were much more able to manipulate syllables than phonemes as evidenced by much higher accuracy scores on the syllable tasks as compared to the phoneme tasks. This confirms the finding that the awareness to larger units (e.g. the syllable) precedes the awareness to smaller units (e.g. the phoneme) found for English and other languages (Ziegler & Goswami 2005). The advantaged status of the syllable as a unit of manipulation can be explained with reference to the development of phonological awareness over time, but also to the phonology of isiXhosa where CV units abound, with few consonant clusters, and codas. Because there are few consonant clusters and codas, the phonology of isiXhosa boosts the awareness to syllables and not phonemes.

Other factors were found to influence phonological awareness performance. These factors are addressed below and include the influence of orthography and school instruction, the influence of morphology, the influence of working memory and processing capacity, and the influence of task difficulty.

5.2.1.1 The effect of transparency and teaching environment

A comprehensive battery of PA tasks was developed for this study. A range of difficulties were chosen including segmenting, identification and deletion. Linguistic units at the level of syllable and phoneme were targeted in each task. For this reason, the tasks successfully overcame criticism that ceiling levels are recorded in PA tasks administered to readers of a transparent orthography (Caravolas & Landerl 2010).

The orthographic representation of the sounds in isiXhosa was addressed in §2.4.3. I classified the isiXhosa orthography as quite transparent but not completely transparent (Table 2, page 22). Although isiXhosa sounds are mostly consistently represented orthographically, the large number of correspondences to be learned may affect the development of phoneme awareness, specifically when teaching instruction does not help the child overcome the sheer number of correspondences to be learned. However, given that the Grade 3 participants are in their third year of literacy instruction it was assumed that phoneme awareness levels would be quite high. Nevertheless, the results show that PA levels in this sample has not yet reached ceiling levels, with a number of participants being unable to complete the tasks accurately. Other studies on Bantu literacy have shown that phoneme awareness presents patterns of continued development (Veii & Everatt 2005, Malda *et al*. 2014). Bimodal distributions in the phoneme identification and phoneme deletion tasks indicated that some participants had not reached the sensitivity to phonemes, also evidenced by their high number of unit errors on the tasks. The sample was split into two according to whether they were sensitive to phonemes or not and the groups differed significantly in their accuracy on the phoneme tasks. Nevertheless, the group which was not sensitive to phonemes still managed to respond correctly to some of the tasks, indicating that they had some sensitivity to phonemes.

The fact that some participants had reached sensitivity and some had not may indicate individual differences in PA, where perhaps the participants who are not yet sensitive to phonemes may have a phonological deficit which might indicate the presence of a reading dysfunction (that would manifest more clearly in the later grades, as the reading processes become more demanding). More research is warranted on the presentation of dyslexia and other learning difficulties in isiXhosa.

There is a trend in the date that the achievement of participants differed by school, perhaps as a result of teaching environment. Participants in school 1 had significantly higher levels of phoneme awareness compared to schools 2 and 3. There was also a trend that school 3 performed the worst. This finding suggests that the teaching environment in different schools may affect the levels of phoneme awareness. Thus, even though there are many phoneme-grapheme correspondences to learn, the teaching in school 1 may have teaching instruction which disambiguates these correspondences for their learners. There is clearly a need for an evidence-based teaching method for the teaching of literacy in isiXhosa that is not simply an adaptation from the English curriculum (de Vos *et al*. 2014).

5.2.1.2 Phonological awareness and orthographic awareness

An analysis of the orthographic errors in the tasks made by both groups confirmed previous findings that readers with higher levels of PA are more likely to make orthographic errors on PA tasks (Landerl *et al*. 1996). Phoneme awareness is affected by exposure to the orthographic representation of phonemes in the language. Thus, participants with better phoneme awareness were more affected by the orthographic representation of phonemes, than their less sensitive counterparts who are still establishing their grapheme-phoneme correspondence knowledge.

On the phoneme segmenting task, participants in Group 1 with higher phoneme awareness made more frequent orthographic errors on the task i.e. treating the task as a spelling task rather than the segmenting of phonemes. Participants in Group 2, who are less aware, were more likely to segment the word into syllables, rather than spell it, although there were some orthographic errors. It must be noted then, that participants with poor levels of phoneme awareness are continuing to develop and cement their grapheme-phoneme correspondences, so they do make some orthographic errors, just not as many as the group with higher phoneme awareness. This was evidenced in the phoneme deletion task. In the phoneme deletion task, participants from both groups were more likely to make errors on the task when the phoneme was not represented by a single letter. This indicates that the phoneme insensitive group is aware of grapheme-phoneme correspondences; they just may not be as well developed as the more sensitive group.

Evidence that Group 1 has more well-developed grapheme-phoneme correspondences is seen in the phoneme identification task. Participants in group 1 were better at identifying the second phoneme, the vowel, than identifying either the first consonant (initial position) or second consonant phoneme (within the word), because there are only five vowels which are presented unambiguously. Group 1 exploited this transparency to better identify the vowel as compared to the consonants. However, Group 2 showed no evidence of being able to exploit the more consistent phoneme mappings. Their results on the position of the phoneme in the word in phoneme identification followed a working memory or limited processing capacity explanation: the first phonemes are the easiest to identify and the other units decreased in accuracy as they moved from the initial position. However, because working memory was not measured this interpretation cannot be confirmed. Participants may have had in tact working memory skills, but were constrained by limited processing capacity to manipulate the sound units. More research is needed to establish the reason.

This discussion has highlighted that participants' knowledge of the orthographic representation of phonemes affects their performance on phoneme awareness tasks, as well as their awareness of phonemes per se. Of course, the reciprocal nature of literacy and phoneme awareness complicates the interpretation of this finding. Either well-developed grapheme-phoneme correspondences improved phoneme awareness for Group 1, or on the other hand, the higher level of phoneme awareness allowed them to develop better grapheme-phoneme correspondences which they used in solving the tasks. A longitudinal study examining the PA of pre-readers as they develop literacy will shed light on the direction of causality.

5.2.1.3 Morphology may help readers overcome limited processing capacity

Another influence on PA performance is that of morphological knowledge. The results of this study confirm previous findings that the morphology of the language can make certain linguistic units more salient than others (Oktay & Aktan 2002, Diemer *et al*. 2015). The results of my study confirm what was found by Diemer *et al*. (2015) that the morphology of isiXhosa makes sounds at the end of words easier to manipulate than units in other positions. However, this effect was only seen for the group with higher levels of PA.

The morphology of isiXhosa results in affixes being added to the end of a root morpheme, with few changes at the beginning of a root morpheme. The results from the syllable identification showed that the group which was more phonologically aware could more easily identify the last syllable of the word. However, the group with lower levels of phonological awareness presented performance that was more constrained by working memory. The first unit was the easiest to identify, and the units after that were more difficult to identify. The results of the syllable deletion task were similar. Group 1 showed effects of morphology improving their awareness of the last syllable, but Group 2 did not.

For phoneme identification, the task mirrored a strategy that could be used in determining the meaning of words in isiXhosa reading. The consonant phonemes in the first and second position of the word were manipulated with the same ease for Group 1. This indicates that Group 1 use their knowledge of morphology to improve their phonological representations of words. When reading, readers may look at the consonant following the vowel to identify the root morpheme. Again, Group 2 presented with results that may be indicative of limited processing capacity, or deficits in working memory.

The picture that emerges is that more phonologically aware readers can probably use their morphological knowledge to overcome constraints on their working memory or processing capacity to complete phonological awareness tasks. Readers who are not as phonologically sensitive seem to be more constrained by working memory or processing capacity when solving phonological awareness tasks. Again, it is difficult to tease out causality: is group 1 more phonologically aware because they have better morphological awareness; are they more morphologically aware because of phonological awareness; or did these awarenesses develop independently and now both are used in solving the tasks? Longitudinal studies are needed, as well as tasks which include more stimuli per position in the word. Phonological working memory and processing capacity should be assessed in future studies to discover their influence on performance at different positions in the word.

5.2.1.4 Task difficulty

The final influence on PA was the difficulty of the task. The literature explains that segmenting has been shown to be the easiest task, identification is an intermediate task and deletion is the most difficult (Anthony *et al*. 2003). The hierarchy of task difficulty presented in the literature is also observed in isiXhosa for syllables, and partially for phonemes.

In the syllable tasks this trend was clearly followed. Syllable segmenting reached ceiling levels, syllable identification was slightly more difficult and syllable segmenting was the most difficult (but it elicited a normal range of results). Syllable segmenting was so easy that word length did not affect performance on this task. The results of the phoneme tasks indicated that performance on the tasks depends on one’s level of sensitivity to phonemes and the length of the stimulus. For participants who have reached sensitivity to phonemes, all the tasks were equally difficult.

However, for Group 1 who showed sensitivity to phonemes, phoneme identification and initial phoneme deletion were equivalent. This indicates that if phoneme deletion had targeted deletion of units at different positions, it would have been the most difficult task. Interestingly, the phoneme segmenting task was the most difficult task, even for the group who had reached sensitivity to phonemes. This low level of performance can be explained with reference to the types of errors on the task. The majority of errors were orthographic interference errors and unit errors, where syllables and not phonemes were segmented. The first type of error highlights that the task was interpreted by some as a spelling task. The second type of error indicates participants' general unwillingness to segment syllables into their constituent phonemes. This may be an indication of a lack of teaching instruction at the phoneme level, an interpretation given by Alcock *et al*. (2010), or it could indicate participants' continued development in establishing phoneme-grapheme correspondences (Veii & Everatt 2005). The fact that word length affected performance negatively on the phoneme segmenting task for both groups indicates that the results are probably not due to working memory differences between the groups, but working memory tasks could provide evidence for this interpretation.

5.2.1.5 Suitability of the phonological awareness test battery

The final part of research question 1 asks whether the PA task developed for this study is suitable in measuring PA in this sample of Grade 3 isiXhosa readers.

The PA tasks used in this study targeted the syllable and phoneme in nonwords in segmenting, identification and deletion tasks. The stimuli followed the phonotactics of isiXhosa and the tasks were carefully constructed with the characteristics of isiXhosa in mind. For example, the phoneme deletion task only targeted the initial phoneme because the deletion of a consonant or vowel within the nonword would result in an unpronounceable string (e.g. /lati/ without /a/ would be */lai/). In retrospect, phoneme deletion could have been targeted in the consonant clusters with /w/, /r/ or /l/ where the consonant in the initial or second position could be targeted. The development of the tasks followed the suggestions of Diemer *et al.* (2015) so they were linguistically appropriate for use with isiXhosa speakers. The use of nonwords eliminated semantic interference. However, the use of sounds which were represented by letter groups was used to determine the extent to which orthography influences phonological awareness in isiXhosa.

The tasks developed for this study worked well, as evidenced by an analysis of the errors produced on each task. It was found that phonological substitution errors were more common in the segmenting tasks, because of either a possible deficit in working memory (so that the correct sounds could not be recalled) or as a result of genuine slips of the tongue. The number of task errors and non-responses increased as task difficulty increased suggesting that there is a need to improve the instructions for some of the tasks. Consideration must be made to include more examples before the task starts and perhaps also include corrective feedback especially for the segmenting tasks which may have been interpreted incorrectly as a spelling task. Tasks which were affected by the length of the stimuli, such as the phoneme segmenting task, should also use shorter stimuli in order to elicit a normal distribution. The use of nonwords is recommended to avoid semantic interference. Likewise, only sounds which are spelled with one letter should be used in future in order to avoid orthographic interference if the goal is to elicit a ‘purer’ measure of PA.

The goal of the current study was to acquire an in depth understanding of PA targeting different units and with different tasks. Future studies may not need to include all measures. Performance varied on all the syllable tasks. The syllable segmenting and identification tasks were not particularly challenging for this sample but could be used with pre-literate children, or by researchers, speech language therapists, educators or psychologists working towards a standardised measure of PA in isiXhosa or other Bantu languages. In this study of Grade 3 speakers, syllable deletion was the only task to elicit a normal distribution and it also explained significant variance in reading accuracy.

I would recommend the inclusion of all the phoneme tasks because they all produced results which had variability. If the goal of the PA results is to determine only phoneme awareness, then only sounds which are spelled with one letter should be used in order to avoid orthographic interference. The use of shorter words in the phoneme segmenting tasks should be considered, as well as the use of props such as bottle tops to help children segment the phonemes. In this way, a truer measure of the sample’s segmenting ability can be found. It could also be established if the poor phoneme segmenting abilities reflect properties of the sample, or the task. In order to avoid a bimodal distribution in the identification and deletion tasks, more examples should be provided to make sure that participants understand what to do. It may be the case that two examples are not sufficient especially considering that the task is unlike anything participants have experience with. The use of corrective feedback may also produce a more normal distribution.

In summary, the PA test battery worked very well for the purposes of this study, enabling the researcher to identify the influence of linguistic unit, task difficulty, orthography, morphology, word length and teaching environment effects. The tasks can be suitably adapted for different purposes. For example, if the purpose of the phonological awareness test is to screen participants quickly, then the phoneme identification task may be the best indicator to stratify students according to performance (based on the results of this study). On the other hand, if the goal of the phonological awareness test is to determine the role of orthographic influence, then that test should include more stimuli with complex orthographic representation.

5.2.2 The relationship between naming speed and phonological awareness

Research Question 2 asked:

2. What is the relationship between phonological awareness and naming speed in isiXhosa?

Evidence from the correlations for the whole sample and for each group suggests that NS and PA are independent from each other. The results of the forward stepwise regressions also suggest an independent relationship. I conclude then that evidence from one NS task and the rang of PA tasks shows that NS and PA may share some variance (that they are both phonological), but NS also probably relates to reading through something which is non-phonological, given the independent contributions to various reading tasks.

The correlations of NS and PA for the whole sample are only moderate ($r_{(S)}$ = .47, p < .001) for NS and Deletion), and when the whole sample was split into the two groups, there was no significant linear relationship between NS and PA. Furthermore, there are higher correlations between the PA tasks than the PA tasks have with NS. The correlational analyses highlighted that PA and NS are not related in any of the two smaller groups and only have a moderate relationship in the whole sample. Other studies have also reported moderate correlations between NS and PA in unselected populations but lower correlations in populations which are selected for performance on a particular measure (Wolf & Bowers 1999).

The results from the forward stepwise regressions for Group 2, only, provides evidence that PA and NS make unique contributions to reading abilities, emphasising that they are separate constructs. For Group 2, NS was the better predictor of reading fluency accounting for 42% of the variance. PA contributed a further 11%. This result shows that PA and NS are separate constructs because they contribute uniquely to the same variable. NS also accounted for unique variance in reading accuracy when syllable deletion as used to measure PA.

What is interesting however is that NS only seems to explain variance in the group with lower levels of PA, providing evidence of a Double Deficit account of reading in isiXhosa. Furthermore, because Group 1 and 2 do not differ significantly in their reading or comprehension ability this suggests that Group 2 has developed an adaptive reading strategy to overcome their lower levels of PA much like what was found for Finnish readers (Leinonen *et al*. 2001).

Since only one measure of RAN was used to measure NS, the findings here are only tentative. In fact, more evidence is needed in order to include the role of NS in the PGS Theory.

5.2.3 The contributions of naming speed and phonological awareness to reading variables and spelling

Research Question 3 asked:

3. What is the contribution of phonological awareness and naming speed to reading fluency, comprehension and spelling in isiXhosa?
    a. How do these findings relate to the trends found in the literature?
    b. Based on 3a, do adaptations need to be made to PGST's conceptualisation of reading?

Results of the forward stepwise regressions confirm that phonological processing is essential for reading in isiXhosa. PA was the best predictor of reading abilities for the whole sample. Results of Group 1 showed that neither PA nor NS were good predictors, and the results of Group 2 indicated that NS was the biggest predictor of reading fluency only, and to an extent of reading accuracy but that PA was also important. Part (b) of question 3 is addressed in §5.3.

That PA explains variance in all the reading variables for the whole sample (fluency, accuracy, comprehension and spelling) is testament to the suggestion that the PA levels of this sample of learners is still developing even in Grade 3. PA explains variance in reading fluency because of its link to establishing grapheme-phoneme correspondences (Ashby *et al*. 2013). The majority of the sample had lower levels of PA and therefore, their less well-developed grapheme-phoneme correspondences lead to less than automatic decoding of words. For this reason, PA contributes to explain reading fluency in the whole sample and Group 2. Group 1 showed no significant contributions of either PA or NS indicating the high levels of performance on these two constructs so that they cease to predict variance in the fluency. On the other hand, NS is the biggest predictor of reading fluency for the group with lower levels of PA, indicating that speed components, or efficient matching of visual and verbal information is important to reading fluency in isiXhosa, especially when phoneme-grapheme correspondences are not well established. It was surprising that naming speed did not explain variance in the whole sample for reading fluency. This is because phonological awareness is still developing for the majority of participants in the sample.

The forward regressions run for reading accuracy also provide evidence that even for the group with better PA, there is still continuity in PA development. PA was the best predictor of reading accuracy. When using syllable deletion as the measure of PA, the role of NS became significant for Group 2, indicating that the speed of matching visual and verbal information is important for this group. Phoneme deletion generally explained much less variance in accuracy because it only targeted the first phoneme.

The results of the regression for comprehension showed that once again, PA was the better predictor probably because of the link to reading accuracy. However, correlations with comprehension were not very strong. NS may have become a significant predictor if there had been more variation in the comprehension results.

The result of the regression for the very small sample of participants, who completed the spelling test, shows that the best predictors of spelling ability are phoneme identification and phoneme segmenting. PA is linked to the establishment of phoneme-grapheme correspondences which are used in spelling. The phoneme identification and segmenting tasks also showed greater influence from orthographic awareness, which is clearly why they are the best predictors for spelling ability. Others had found that NS is not a significant contributor to spelling (Moll *et al*. 2009, Cummine *et al*. 2015).

The data show that PA is still developing in this sample of Grade 3 isiXhosa readers, which lead to the significant contribution of PA to all reading variables, even fluency. The role of NS is confined to participants who have lower levels of PA, and it primarily exerts its influence on reading fluency and a smaller significant influence in reading accuracy.

5.3 Relevance to theory

The last part of research question 3 asks whether adaptations need to be made to PGST based on the findings from this study.

The Psycholinguistic Grain Size Theory emphasises the role of PA for phonological recoding at the different grain sizes. One of the goals of the study was to determine whether similar findings were made in isiXhosa as in other languages which are also written transparently. Furthermore, another goal was to determine if PA was a good predictor of various reading abilities in isiXhosa, as the PGST suggests. Finally, the role of NS was explored. PGST explains skilled and dysfunctional reading but it does not adequately address the role of NS for reading. Other theories of disabled reading have highlighted NS as another important factor to consider in reading disabilities. If it is the case that NS does predict reading in a dyslexic population, then there is a need for PGST to address its role in the theory if it purports to explain all types of reading.

There is evidence that a phonological route is used by all the participants in this study, but that NS does predict reading fluency and accuracy for readers with low levels of PA. To note is that in Group 1, reading fluency was predicted by neither PA nor NS emphasising that better readers probably rely on vocabulary and contextual factors for text reading speed. I argue that PGST can only explain the role of NS in the development or use of different grain sizes once a conceptual definition of NS has been reached.

Evidence summarized earlier suggests that NS is not only related to reading through its phonological components. Data from other studies also show that NS may be used to develop orthographic representations (Norton & Wolf 2012). A possible alternate definition suggested by Moll *et al*. (2009) could work well within a PGST framework. They suggest that NS measures the "automaticity of orthography to phonology associations at the letter and letter cluster level" (Moll *et al*. 2009: 22). Thus, where PA is used to establish the grain size or orthography-phonology correspondence accurately, NS could hypothetically measure the amount of time it takes to correspond the letter or letter clusters on the page to the phonological grain it represents. In PGST, accuracy is achieved by using the correct grain size for the requirements of the task, however it is more silent about how fluency is achieved (Wimmer 2006). This conceptual definition of NS could therefore be used in explaining how fluency is achieved in PGST.

NS ceases to be a good predictor of reading skills in fluent readers in this sample because of how it develops. In the early grades it improves steeply, but at a certain threshold level it flattens out and ceases to predict reading fluency for better readers (Wolf & Bowers 1999). If NS measures the automaticity of orthography-phonology correspondences this suggests that readers learn how to become faster at this as they practice reading. After a certain point, the speed of corresponding orthography (at the letter/ letter cluster level) to phonology (syllable or phoneme grain) has reached its highest level and cannot be improved. On the other hand, the role of phonological awareness is in the accuracy of grapheme-phoneme correspondences. Readers must learn that the letter or letter groups correspond to particular sounds in their language. Phonemically insensitive readers take longer to establish accurate grapheme-phoneme correspondences or grain sizes.

For this reason, NS was the better predictor of reading fluency in the group with less accurate phonological representations. The less well-developed grapheme-phoneme correspondence knowledge of Group 2 may have exacerbated the time it took readers to match the orthographic representations to phonological representations. Reading accuracy was also additionally predicted by NS in this group because if readers take longer to match the grapheme to the phoneme they may be more likely to select an inaccurate match. The influence of low speed of orthography-phonology mapping should be more pronounced when reading with a small grain size because more correspondences have to be made. This is evidenced in the results from the comprehension regression where NS was the only predictor of comprehension in Group 2 although it did not reach significance. This finding indicates that a suggested lack of automaticity in decoding lead to lower levels of comprehension. Although conducted on a small sample size, the evidence from the spelling task shows that only accurate grapheme-phoneme correspondences are necessary for spelling. This finding may also reflect the characteristics of this sample which completed the spelling task that had above average levels of NS and could therefore pattern like Group 1, which did not show effects of NS on the reading variables.

This study showed that for the most part, a single phonological route can account for reading in isiXhosa. The role of NS in a PGST explanation of reading requires that the conceptual definition of NS be decided on. The suggestion that NS measures the automaticity of orthography-phonology correspondences (at the syllable and phoneme grain size) fits well in a PGST approach to explaining reading, and there appears to be evidence from this study to support this conceptual definition. Clearly more research is needed to identify why NS is related to reading.

5.4 Relevance to method

The suitability of the PA tasks was reported in §5.2.1.5. The coding of different types of errors on the PA tasks provided rich information on why errors occurred. Studies which seek to provide an in-depth analysis of PA should consider analyzing the errors in addition to the accuracy on the tasks.

The Rapid Automatized Naming Task, which measured NS, was a suitable task because it produced normal distributions. Participants were required to name the numbers in isiXhosa only. The use of screening methods (the digits presented individually and the practice board) to identify participants who could not name numbers automatically in isiXhosa was very useful. Twelve participants were excluded from the sample because they presented a lack of automaticity in number naming in isiXhosa. Mention was made in §3.4.1.1 on page 64 that it may not have been fair to ask participants to name in isiXhosa if numbers are often taught in English and are more automatic in English. For future studies, participants could be asked to name in English as well and the results compared. A larger battery of RAN tasks could be used in future studies to provide more evidence of the role of different types of RAN for reading

Reading ability was measured by asking participants to read orally and silently for one minute from different texts. Comprehension questions were asked after the text reading tasks. The tasks provided a good measure of reading ability because they examined reading in oral and silent modes. Performance in the oral version was lower than in the silent version stressing the importance of using tasks which measure both modes so the results can be more representative of general reading ability. I recommend that future studies determine a way to identify text difficulty, and if this is not possible, to counterbalance the modes on the texts so that one text is read silently by half the sample and the other text is read orally by half the sample and vice versa. This will ensure that text difficulty does not affect results. I would also recommend allowing participants to read for at least 3 minutes and then averaging the number of words to get a Words per Minute score. This will allow for a more representative measurement of reading fluency. Researchers could also consider using word and nonword lists to provide a more context free measure of reading ability. It could be the case that readers guessed words in the text reading because they could rely on contextual cues. Use of word lists could also allow researchers to identify the grain size that readers rely on to read in isiXhosa.

The comprehension measure developed for this study was not sensitive enough to separate good comprehenders from bad comprehenders firstly because it contained only 5 items, and secondly because it was linked to performance on the previous reading task. Results were generally very low on this task. However, poor levels of comprehension were also found in a study on Setswana speakers (Malda *et al*. 2014). Future research should include a more nuanced comprehension test that is independent of any of the other tasks used in the study such as a cloze procedure, or a decision task where readers read sentences and must mark whether they are true or false.

The use of a nonword spelling test sheds light on spelling abilities. Since most participants performed quite well on this task, more stimuli could be introduced in future studies. Furthermore, there may also be benefit in examining the spelling of real words, where grammatical and morphological knowledge can be relied on for spelling (Alcock & Ngorosho 2003).

In conclusion, the measures used in this study were suited to the goal of this study which was to provide an in-depth analysis of phonological awareness, and to examine the contributions to different reading variables. Of course, if the goal of a future study is different, the type of tasks should be considered for their match to the outcome of the research.

5.5 Relevance to South Africa

The results of this study may reflect and can inform pedagogic practice.

The results of this study may reflect pedagogic practice because there is evidence that the levels of PA have still not reached ceiling levels in isiXhosa, even though it is written relatively transparently. As reported in other studies (Veii & Everatt 2005, Alcock *et al*. 2010), the phonological development of this sample of Grade 3 isiXhosa readers shows that they can still improve. This is surprising given that the simple syllable structure and relatively transparent orthography should boost phoneme awareness. The fact that not all participants have reached sensitivity to phonemes could possibly be related to teaching practice, where the phoneme is not focused on. Rather letter-sound correspondences are taught through syllables, e.g. [b] is taught through rote learning of *ba, be, bi, bo, bu* (de Vos *et al*. 2014). Since children are left to work out reading strategies for themselves, it takes them longer to develop phoneme awareness, especially when there are many orthography-phonology correspondences to learn.

Data from this study suggests that teaching environment could affect levels of phoneme awareness (but not syllable awareness). Participants from school 1 have much higher levels of phoneme awareness than those from the other schools, suggesting that the levels of phoneme awareness in this study can be subject to improvement. In fact, research shows that phonological awareness responds well to intervention (Gillon 2004). There is therefore much opportunity for researchers to design PA interventions for isiXhosa speakers.

The results of this study show that PA is an important predictor for reading in isiXhosa. There is therefore evidence that a phonics approach could work very well to fast track the development of phoneme awareness, and automaticity in orthography-phonology correspondences. A phonics approach is warranted considering the large number of correspondences that must be learned in isiXhosa in order to become a good reader. Furthermore, an approach which capitalizes on improving morphological awareness may also contribute to improving levels of phoneme awareness, because of the link found in my study between performance on phonological awareness and the influence of morphology in manipulating units at different positions in the word. Finally, the role of syllable awareness must not be forgotten. Syllable awareness is a better predictor of reading accuracy and consideration of how isiXhosa advantages the syllable over the phoneme may explain this. Research is needed to establish the order of phonics instruction and reading materials which are developed for beginner readers.

Lastly, the contributions of PA and NS to reading in isiXhosa are for the most part consistent with what is presented in the literature on other languages. For this reason, findings from other languages with similar problems, such as Finnish which is written transparently and is also agglutinating, can inform pedagogic practice for isiXhosa literacy instruction. Caution must be taken to identify the dissimilarities, such as isiXhosa having many more correspondences to learn. It is very useful to know that a similar process underlies reading in isiXhosa and other languages, because it enables the transference of teaching knowledge about one language to another.

5.6 Limitations and suggestions

The largest limitation to this research was the high attrition rate of participants. The original sample of 93 participants was reduced to 52 because of missing data, or some participants not knowing numbers in isiXhosa. The high attrition rate can be attributed to the very strict exclusion procedures applied in this study, as well as the thorough recording of participants’ responses to the tasks. Future studies should streamline the data collection procedure especially when there is a large number of tasks, and multiple research venues.

Another limitation to the study is that it only focused on two cognitive linguistic aspects of reading. The current study is limited in that it did not take into account the third phonological processing skill, phonological working memory. Phonological working memory seemed to be a factor affecting responses on the phonological awareness results and a measure of this skill could have further explained the findings. In addition, PA and NS were only tested in the participants' first language. These participants are emergent bilingual because they have been learning English in school from first grade. For a complete understanding of participants' literacy achievement, PA and NS should have been examined in both their first and second language.

For the bigger picture, more breadth could have been achieved had teachers been interviewed about their teaching methods, or parents interviewed about their bed-time story reading habits. This quantity of data was however unnecessary for this study since the main goal was only to determine the roles of NS and PA to reading variables. By focusing only on these two variables, there was far more depth in the analysis for the smaller scope. Future studies should record the teaching methods in the schools as instruction affects the awareness to phonemes, as well as record the reading habits of participants since print exposure can affect PA (Gillon 2004).

The large age range in participants, first highlighted in §3.2, may also have affected the results. Participants who are older may have remained in the early grades because of undiagnosed learning difficulties. The data are suggestive of a potential phonological deficit in Group 2, characteristic of dyslexia. The findings from the contributions of NS and PA to reading fluency in this sample supported the predictions of the DDH. However, this group did not read significantly fewer words per minute than Group 1. This suggests that Group 2 have developed another reading strategy. The use of text reading as a measure of reading fluency could not conclusively determine what this strategy might be. Research on a larger sample of participants and use of word and nonword reading accuracy and speed may shed light on the reading strategies and grain size used by readers of isiXhosa. It would be very useful to know what the characteristics of good and poor readers of isiXhosa are. Evidence from this study would suggest that readers with higher levels of phonological awareness use a larger grain size for reading, considering that neither PA nor NS explained reading fluency for this group. However, the groups with poor levels of PA may use a grapheme-phoneme recoding strategy, especially because both NS and PA predicted reading fluency for that group. Future studies should aim to exclude participants who are "too old"[9] for the grade.

5.7 Closing remarks

In conclusion, the results of this study showed that PA is important for reading accuracy, fluency, comprehension and spelling as it is in other languages. The role of NS is narrower, confined to predicting the fluency and accuracy of reading only in the group with poor phonological awareness. This suggested that NS measures something that is not only phonological. A conceptual definition of NS as measuring the automaticity of orthography-phonology relations was supported in the data. It was explained that the role of NS in the development and use of grains of different sizes should be addressed by the Psycholinguistic Grain Size Theory. However, it was established that the role of NS in developing and using grains of different sizes in reading can only be outlined once a conceptual definition of NS has been agreed upon by scholars in the reading field.

The PA of participants in this sample showed great variability suggesting continued development in this psycholinguistic skill. This finding was unexpected considering that the relatively transparent nature of isiXhosa should boost phoneme awareness. The analysis of the correspondences needed to read isiXhosa showed that although isiXhosa may be relatively transparently written, there are many correspondences to learn, which may account for why phoneme awareness is still developing in this Grade 3 sample. Finally, the role of teaching instruction could improve readers' PA abilities but more research is needed on the best phonics approach in isiXhosa.

This study adds to a growing body of literature on the roles of micro-linguistic skills to reading development and has highlighted a number of avenues for future research.

[9] The anonymous examiner of this thesis suggested that this cut-off point be one year older than the expected age in order to increase homogeneity in the sample and to avoid the inclusion of participants with undiagnosed learning difficulties.

REFERENCES

Abbhul, R., Gass, S. & Mackey, A., 2013. Experimental Research Design. In: R. J. Podesva & D. Sharma, eds. *Research Methods in Linguistics.* New York: Cambridge University Press, pp. 116 - 134.

Adams, M., 1990. *Beginning to Read: Thinking and Learning about Print.* Cambridge: MIT Press.

Adams, M. J., 2011. The relation between alphabetic basics, word recognition and reading. In: S. J. Samuels & A. E. Farstrup, eds. *What Research has to say about Reading Instruction.* Fourth ed. Newark, DE: International Reading Association, pp. 4-24.

Alcock, K. H. & Ngorosho, D., 2003. Learning to spell a regularly spelled language is not a trivial task - patterns of errors in Kiswahili. *Reading and Writing,* 16, pp. 635-666.

Alcock, K. J., Ngorosho, D., Deus, C. & Jukes, M. C. H., 2010. We don't have language at our house: Disentangling the relationship between phonological awareness, schooling and literacy. *British Journal of Educational Psychology,* 80(1), pp. 55-76.

Alloway, T. P., Gathercole, S. E., Willis, C. & Adams, A.-M., 2004. A structural analysis of working memory and related cognitive skills in young children. *Journal of Experimental Child Psychology,* 87, pp. 85-106.

Anthony, J. L. & Francis, D. J., 2005. Development of Phonological Awareness. *Current Directions in Psychological Science,* 14(5), pp. 255-259.

Anthony, J., Lonigan, C., Driscoll, K. & Phillips, B. B. S., 2003. Phonological Sensitivity: A quasi-parallel progression of word structure units and cognitive operation. *Reading Research Quarterly,* 38, pp. 470-487.

Aro, M., 2004. *Learning to Read: The Effect of Orthography.* Jyvaskyla: University of Jyvaskyla.

Ashby, J., Dix, H., Bontrager, M., Dey, R., Archer, A., 2013. Phonemic awareness contributes to text reading fluency: evidence from eye movements. *School Psychology Review,* 42(2), pp. 157-170.

Bester, M. no date. Iinkonde ziyankqonkqoza. In Sunday Times Ixesha lamabli. CTP Printers: Cape Town.

Boets, B., Wouters, J., van Wieringen, A., De Smedt, B. & Ghesquiere, P., 2008. Modeling relations between sensory processing, speech perception, orthographic and phonological ability, and literacy achievement. Brain and Language, 106, pp. 29 – 40.

Bolger, D. J., Perfetti, C. A. & Schneider, W., 2005. Cross-cultural effects on the brain revisited: universal structure plus writing system variation. *Human Brain Mapping,* 25, pp. 92-104.

Button, K.S., Katherine S., Ioannidis, J.P.A., Mokrysz, C., Nosek, B.A., Flint, J., Robinson, E.S.J., & Munafo, M.R, 2013. Power Failure: why small smaple size undermines the reliability of neuroscience. *Nature Reviews Neuroscience,* 14, pp. 365-376.

Caravolas, M. & Bruck, M., 1993. The effect of oral and written language input on children's phonological awareness: a cross-linguistic study. *Journal of Experimental Child Psychology*, 55(1), pp. 1-30.

Caravolas, M. & Landerl, K., 2010. The Influences of Syllable Structure and Reading Ability on the Development of Phoneme Awareness: A Longitudinal, Cross-linguistic Study. *Scientific Studies of Reading,* 14(5), pp. 464-484.

Caravolas, M., Volin, J. & Hulme, C., 2005. Phoneme awareness is a key component of alphabetic literacy skills in consistent and inconsistent orthographies: Evidence from Czech and English children. *Journal of Experimental Child Psychology,* 92, pp. 107-139.

Carlisle, J., 2003. Morphology matters in learning to read: a commentary. *Reading Psychology,* 24, pp. 291-322.

Cassady, J., Smith, L. & Putman, S., 2008. Phonological awareness development as a discrete process: Evidence for an integrative model. *Reading Psychology,* 29, pp. 508-533.

Castles, A., Wilson, K. & Coltheart, M., 2010. Early orthographic influences on phonemic awareness tasks: evidence from a preschool training study. *Journal of Experimental Child Psychology,* 108, pp. 203-210.

Catts, H. W., Herrera, S., Nielsen, D. C. & Bridges, M. S., 2015. Early prediction of reading comprehension within the simple view framework. *Reading and Writing,* 28(9), pp. 1407 - 1425.

Chard, D. J., Pikulski, J. J. & Templeton, S., 2000. From phonemic awareness to fluency: effective decoding instruction in a research-based reading program. *Current Reading Research,* pp. 1-10.

Clinton, A., Christo, C. & Shriberg, D., 2013. Learning to read in Spanish: Contributions of phonological awareness, orthographic coding, and rapid naming. *International Journal of School and Educational Psychology,* 1(1), pp. 36-46.

Compton, D. L., Olson, R. K., DeFries, J. C. & Pennington, B. F., 2002. Comparing the relationships among two different versions of the alphanumeric rapid automatized naming and word level reading skills. *Scientific Studies of Reading,* 6, pp. 343-368.

Cossu, G., Shankweiler, D., Liberman, I. Y. & Tola, G., 1988. Awareness of phonological segments and reading ability in Italian children. *Applied Psycholinguistics,* 9, pp. 1-16.

Cummine, J., Chouinard, B., Szepesvari, E. & Georgiou, G. K., 2015. An examination of the rapid automatized naming-reading relationship using functional magnetic resonance imaging. *Neuroscience,* 305, pp. 49-66.

de Jong, P. & van der Leij, A., 1999. Specific contributions of phonological abilities to early reading acquisition: resutls from a Dutch latent variable longitudinal study. *Journal of Educational Psychology,* 91, pp. 450-476.

de Vos, M., van der Merwe, K. & van der Mescht, C., 2014. A Linguistic Research Programme for Reading in African Languages to underpin CAPS. *Journal for Language Teaching,* 48, pp. 143-177.

Denckla, M., 1972. Colour-naming defects in dyslexic boys. *Cortex,* 8, pp. 164-176.

Denckla, M. B. & Rudel, R. G., 1974. "Rapid Automatized Naming" of pictured objects, colours, letters and numbers by normal children. *Cortex,* 10, pp. 186-202.

Denckla, M. B. & Rudel, R. G., 1976a. Naming of objects by dyslexic and other learning-disabled children. *Brain and Language,* 3(1), pp. 1-15.

Denckla, M. B. & Rudel, R. G., 1976b. Rapid 'Automatized' Naming (R.A.N.): Dyslexia differentiated from other learning disabilities. *Neuropsychologia,* 14, pp. 471-479.

Department of Basic Education, 1998. Age requirements for admission to an ordinary public school. *Government Gazette,* 19 October.400(19377).

Department of Basic Education, 2010. *The status of the Language of Learning and Teaching (LoLT) in South African Public Schools: a Quantitative Overview,* Pretoria: DBE.

Department of Basic Education, 2011. *National Curriculum Statement (NSC) Curriculum and Assessment Policy Statement: Foundation Phase Grades R-3: isiXhosa Home Language.* Pretoria: Government Printing Works.

Diemer, M., van der Merwe, K. & de Vos, M., 2015. The development of phonological awareness literacy measures for isiXhosa. *Southern African Linguistics and Applied Language Studies*, 33(3), pp. 325 – 341.

Doke, C., 1954. *The Southern Bantu Languages.* London: Oxford University Press.

Durgonoglu, A. Y. & Oney, B., 1999. A cross-linguistic transfer of phonological awareness and word recognition. *Reading and Writing,* 11, pp. 281-299.

Durgunoglu, A., 2006. Learning to read in Turkish: Commentary on Ziegler and Goswami (2006). *Developmental Science,* pp. 437-439.

Eckert, P., 2013. Ethics in linguistic research. In: R. J. Podesva & D. Sharma, eds. *Research Methods in Linguistics.* New York: Cambridge University Press, pp. 11 - 26.

Frost, R., 2012. Towards a universal model of reading. *Behavioural and Brain Sciences,* 35, pp. 263-329.

Fuchs, L. S., Fuchs, D., Hosp, M. K. & Jenkins, J. R., 2001. Oral reading fluency as an indicator of reaidng competence: a theoretical, empirical, and historical analysis. *Scientific Studies of Reading,* 5(3), pp. 239-256.

Georgiou, G. K., Aro, M., Liao, C. & Parrila, R., 2016. Modeling the relationship between rapid automatized naming and literacy skills across languages varying in orthographic consistency. Journal of Experimental Child Psychology, 143, pp. 48-64.

Georgiou, G. K., Papdopoulos, T. C. & Kaizer, E. L., 2014. Different RAN components relate to reading at different points in time. *Reading and Writing,* 27(3), pp. 1379-1394.

Georgiou, G. K. & Parrila, R., 2013. Rapid Automatized Naming and Reading: A review. In: H. L. Swanson, K. R. Harris & S. Graham, eds. *Handbook of Learning Disabilities.* Second ed. New York: Guilford Press, pp. 169-185.

Georgiou, G. K., Parrila, R., Liu, Y. & Papadopoulos, T. C., 2013. Why is rapid automatized naming related to reading?. *Journal of Experimental Child Psychology,* 115, pp. 218-225.

Georgiou, G., Parrila, R. & Papadopoulos, T., 2008. Predictors of word decoding and reading fluency across lanaguges varying in orthographic consistency. *Journal of Educational Psychology,* 100(3), pp. 566 – 580.

Geschwind, N., 1965. Disconnection syndrome in animals and man (Parts I, II). *Brain,* 88, pp. 585-644.

Gillon, G., 2004. *Phonological Awareness: from Research to Practice.* New York: Guilford Press.

Goswami, U., 2009. The Basic Processes in Reading: Insights from Neuroscience. In: D. R. Olson & N. Torrance, eds. *The Cambridge Handbook of Literacy.* New York: Cambridge University Press, pp. 134-151.

Goswami, U. & Ziegler, J., 2006. Fluency, phonology and morphology: a response to the commentaries on becoming literate in different languages. *Developmental Science,* 9(5), pp. 451-453.

Goswami, U., Ziegler, J., Dalton, L. & Schneider, W., 2003. Nonword reading across orthographies: How flexible is the choice of reading units?. *Applied Psycholinguistics,* pp. 235-247.

Greenop, K., 2004. *The development of literacy skills in Zulu and Northern Sotho speaking children: A cognitive-neuropsychological investigation.* Unpublished Doctoral Thesis. Johannesburg: University of the Witwatersrand.

Halladay, J. L., 2012. Revisiting the key assumptions of the reading level framework. *The Reading Teacher,* 66(1), pp. 53-62.

Hasbrouck, J. & Tindal, G., 2006. Oral Reading Norms: A valuable assessment tool for reading teachers. *The Reading Teacher*, 59(1), pp. 636 - 644.

Hartmann, W., no date. IMokoro yemiLingo. In Sunday Times: Ixesha lamabali. CTP Printers: Cape Town.

Howell, D., 2008. The analysis of missing data. In: *Handbook of Social Science Methodology.* London: Sage.

Howie, S., Venter, E., van Staden, S., Zimmerman, L., Long, C., du Toit, C., Scherman, V., & Archer, E., 2008. *PIRLS 2006 Summary Report: South African Children's Reading Achievement,* South Africa: Centre for Evaluation and Assessment.

Hulme, C., Caravolas, M., Malkova, G. & Brigstocke, S., 2005. Phoneme isolation ability is not simply a consequence of letter-sound knowledge. *Cognition,* 97, pp. B1-B11.

Hurlstone, M. J., Hitch, G. J. & Baddeley, A. D., 2014. Memory for serial order across domains: an overview of the literature and directions for future research. *Psychological Bulletin,* 140(2), pp. 339-373.

Johnston, T. C. & Kirby, J. R., 2006. The contribution of naming speed to the simple view of reading.. *Reading and Writing*, 19(4), pp. 339-361.

Katz, L. & Frost, R., 1992. The reading process is differnt for different orthographies: the orthograhic depth hypothesis. *Haskins Laboratories Status Report on Speech Research,* 111/112, pp. 147-160.

Kirby, J.R., Georgiou, G.K., Martinussen, R., Parrila, R., Bowers, P., Landerl, K., 2010. Naming Speed and Reading: From Prediction to Instruction. *Reading Research Quarterly,* 45(3), pp. 341-362.

Kirby, J., Parrila, R. & Pfeiffer, S., 2003. Naming Speed and Phonological Awareness as Predictors of Reading Development. *Journal of Educational Psychology,* 95(3), pp. 453-464.

Kuhn, M. R., Schwanenflugel, P.J., Meisinger, E.B., Levy, B.A., Rasinski, T.V., 2010. Aligning theory and assessment of reading fluency: automaticity, prosody, and definitions of fluency. *Reading Research Quarterly,* 45(2), pp. 230-251.

Landerl, K., Frith, U. & Wimmer, H., 1996. Intrusion of orthographic knowledge on phonemic awareness: strong in normal readers, weak in dyslexic readers. *Applied Psycholinguistics,* 17, pp. 1-14.

Land, S., 2011. Open to the flaw:Comparing the different skills required for reading English and isiZulu. *Language Matters: Studies in the Langauges of Africa,* 42(1), pp. 50-68.

Land, S., 2015. Reading and the orthography of isiZulu. *South African Journal of African Languages,* 35(2), pp. 163 – 175.

Leinonen, S., Muller, K., Leppanen, P.H.T., Aro, M., Ahonen, T., Lyytinen, H., 2001. Heterogeneity in adult dyslexic readers: relating processing skills to the speed and accuracy of oral text reading. *Reading and Writing,* 14, pp. 265-296.

Lekgoko, O. & Winskel, H., 2008. Learning to read in Setswana and English: cross-language transference of letter-knowledge, phonological awareness and word reading skills. *Perspectives in Education,* 26(4), pp. 57 - 73.

Liberman, I. Y., Shankweiler, D., Fischer, F. W. & Carter, B., 1974. Explicit syllable and phoneme segmentation in the young child. *Journal of Experimental Psychology,* 18, pp. 201-212.

Liberman, I. Y., Shankweiler, D. & Liberman, A. M., 1989. The alphabetic principle and learning to read. In: *Reprinted from "Phonology and Reading disability: Solving the reading puzzle".* s.l.:National Institute of Child Health and Human Development, pp. 1 - 38.

Louw, P., 2005. A new definition of Xhosa grapheme-phoneme rules for automatic transcription. *South African Journal of African Languages,* 25(2), pp. 71-91.

Louwrens, L. & Poulos, G., 2006. The status of the word in selected conventional writing systems - the case of disjunctive writing. *Southern African Linguistics and Applied Language Studies,* 24(3), pp. 389-401.

Mahon, C., 2010. *Recombinative Generalisation and Psycholinguistic Grain Size: An Investigation of reading related skills in adult readers and children with learning disabilities,* Doctoral Thesis: The National University of Ireland.

Malda, M., Nel, C. & van de Vijver, F., 2014. The road to reading for South African learners: the role of orthographic depth. *Learning and Individual Differences,* 30, pp. 34-45.

Manis, F. R., Doi, L. M. & Bhadha, B., 2000. Naming speed, phonological awareness, and orthographic knowledge in second graders. *Journal of Learning Disabilities,* 33, pp. 323 - 333.

Mann, V. A. & Liberman, I. Y., 1984. Phonological awareness and verbal short-term memory. *Journla of Learning Disabilities,* 17(10), pp. 592-599.

Marinus, E. & de Jong, P. F., 2010. Variability in the word-reading performance of dyslexic readers: effects of word length, phoneme length and digraph presence. *Cortex,* 42, pp. 1259-1271.

Maxwell, S. E., 2000. Sample size and multiple regression analysis. *Psychological Methods,* 5(4), pp. 434-458.

McGuinness, D., 2005. *Language Development and Learning to Read.* First Edition ed. USA: MIT Press.

Melby-Lervag, M., Lyster, S.-A. H. & Hulme, C., 2012. Phonological skills and their roles in learning to read: a meta-analytic review. *Psychological Bulletin,* 138, pp. 322-352.

Miller, P., Kargin, T. & Guldenoglu, B., 2012. Differences in the reading of shallow and deep orthography: developmental evidence from Hebrew and Turkish readers. *Journal of Research in Reading,* 37(4), pp. 409-432.

Moll, K., Fussenegger, B., Willburger, E. & Landerl, K., 2009. RAN is not a measure of orthogrpahic processing. Evidence from the asymmetric German orthography. *Scientific Studies of Reading,* 13(1), pp. 1-25.

Moll, K., Ramus, F., Bartling, J., Bruder, J., Kunze, S., Neuhoff, N., Streiftau, S., Lyytinen, H., Leppanen, P.H.T., Lohvansuu, K., Toth, D., Honbolygo, F., Csepe, V., Bogliotti, C., Iannuzzi, S., Demonet, J., Longeras, E., Valdois, S., George, F., Soares-Boucaud, I., Le Heuzey, M., Billard, C., O'Donovan, M., Hill, G., Williams, J., Brandeis, D., Maurer, U., Schulz, E., van der Mark, S., Muller-Myhsok, B., Schulte-Korne, G., Landerl, K., 2014. Cognitive mechanisms underlying reading and spelling development in five European orthographies. *Learning and Instruction,* 29, pp. 65-77.

Morais, J., Alegria, J., Bertelson, P. & Cary, L., 1979. Does the awareness of speech as a sequency of phones arise spontaneously?. *Cognition,* 7, pp. 323-331.

Myers, S. P., 1987. “Tone and the structure of words in Shona”. Doctoral Thesis. University of Massachusetts.

Norton, E. S. & Wolf, M., 2012. Rapid Automatized Naming (RAN) and Reading Fluency: Implications for Understanding and Treatment of Reading Disabilities. *Annual Review of Psychology,* 63, pp. 427-452.

Oktay, A. & Aktan, E., 2002. A cross-linguistic comparison of phonological awareness and word recognition in Turkish and English. *International Journal of Early Years Education,* 10(1), pp. 37 - 48.

Osborne, J. & Waters, E., 2002. Four Assumptions of multiple regression that researchers should always test. *Practical Assessment, Research & Evaluation,* 8(2).

Paulesu, E., 2006. On the advantage of 'shallow' orthographies: number and grain size or the orthographic units or consistency per se?. *Developmental Science,* 9(5), pp. 443-444.

Pretorius, E. J., 2002. Reading and applied linguistics - a deafening silence?. *Southern African Linguistics and Applied Language Studies,* 20(1-2), pp. 91-103.

Pretorius, E. J., 2010. Issues of complexity in reading: Putting Occam's razor aside for now. *Southern African Linguistics and Applied Language Studies,* 28(4), pp. 339-356.

Pretorius, E. J. & Mokhwesana, M. M., 2009. Putting reading in Northern Sotho on track in the early years: Changing resources, expectations and practices in a high poverty school. *South African Journal of African Languages,* 1, pp. 54-73.

Rakhlin, N., Cardoso-Martins, C. & Grigorenko, E. L., 2014. Phonemic awareness is a more important predictor of orthographic processing that rapid serial naming: evidence from Russian. *Scientific Studies of Reading,* 18, pp. 395-414.

Rasinski, T., 2004. Creating fluent readers. *Educational Leadership,* 61(6), pp. 46-51.

Rasinski, T. V. & Samuels, S. J., 2011. Reading fluency: what it is and what it is not. In: S. J. Samuels & A. E. Farstrup, eds. *What research has to say about reading instruction.* Newark, DE: International Reading Association, pp. 94 - 114.

Read, C., Zhang, Y., Nie, H. & Ding, B., 1986. The ability to manipulate speech sounds depends on knowing alphabetic writing. *Cognition,* 24, pp. 31-34.

Rees, S., 2016. “Morphological Awareness in isiXhosa Readers”. Unpublished Masters Thesis. Grahamstown: Rhodes University.

Rubin, D., 1976. Inference and Missing Data. *Biometrika,* 63(3), pp. 581-592.

Saiegh-Haddad, E., Kogan, N. & Walters, J., 2010. Universal and language-specific constraints on phonemic awareness: evidence from Russian-Hebrew bilingual children. *Reading and Writing,* 23, pp. 359-384.

Saul, Z. W., 2013. “The significance of accuracy in the orthographical development of isiXhosa in a post-democratic South Africa”. Unpublished Doctoral Thesis. University of Fort Hare.

Savage, R. & Frederickson, N., 2005. Evidence of a highly specific relationship between rapid automatic naming of digits and text-reading speed. *Brain and Language,* 93, pp. 152-159.

Schaefer, B., Fricke, S., Szczerbinski, M., Fox-Boyer, A.V., Stackhouse, J., Wells, B., 2009. Development of a test battery for assessing phonological awareness in German-speaking children. *Clinical Linguistics & Phonetics,* 23(6), pp. 404-430.

Scheule, C. & Boudreau, D., 2008. Phonological Awareness Intervention: Beyond the Basics. *Language, Speech and Hearing Services in Schools,* 39, pp. 3-20.

Seymour, P., Aro, M. & Erskine, J., 2003. Foundation literacy acquisition in European orthographies. *British Journal of Psychology,* 94, pp. 143-174.

Shankweiler, D. & Fowler, A. E., 2004. Questions people ask about the role of phonological processes in learning to read. *Reading and Writing: An Interdisciplinary Journal,* 17, pp. 483-515.

Share, D., 1995. Phonological recoding and self-teaching: the sine qua non of reading acquisition. *Cognition,* 55, pp. 151-288.

Share, D., 2008. On the Anglocentricities of Current Reading Research and Practice: The Perils of Overreliance on an "Outlier" Orthography. *Psychological Bulletin,* 134(4), pp. 584-615.

Shin, M., Good, R.H., Knutson, N., Collins, V.L., Tilly, W.D., 1992. Curriculum-based measurement of oral reading fluency: a confirmatory analysis of its relation to reading. *School Psychology Review*, 21(3), pp. 459-479.

Simon, S., 2008. *P. Mean: A standard deviation that is too big for its own britches.* [Online] Available at: http://www.pmean.com/08/SdTooBig.html
[Accessed 5 October 2015].

Stanovich, K., 1987. Perspectives on segmental analysis and alphabetic literacy. *Cahiers Psychologie Cognitive,* 7, pp. 514-519.

Stanovich, K. E., 2000. *Progress in Understanding Reading: Scientific Foundations and New Frontiers.* New York: Guilford Press.

Swanson, H. L., Trainin, G., Necoechea, D. M. & Hammil, D. D., 2003. Rapid naming, phonological awareness, and reading: a meta-analysis of the correlation evidence. *American Educational Research Association,* 73, pp. 407-440.

Sweet, R. W., 2004. The Big Picture: where we are nationally on the reading front and how we got here. In: P. McCardle & V. Chhabra, eds. *The Voice of Evidence in Reading Research.* York: Paul H Brookes Publishing Company, pp. 13-44.

Thompson, M. L., 1978. Selection of variables in multiple regression: Part I. A Review and Evaluation. *International Statistical Review,* 46(1), pp. 1-19.

University of Fort Hare, 1989. *The Greater Dictionary of Xhosa: Q to Z.* Alice: University of Fort Hare.

Vaessen, A., Bertrad, D., Toth, D., Csepe, V., Faisca, L., & Reis, A., 2010. Cognitive Development of fluent word reading does not qualitatively different between transparent and opaque orthographies. *Journal of Educational Psychology,* 102(4), pp. 827-842.

Vaessen, A. & Blomert, L., 2010. Long-term cognitive dynamics of fluent reading development. *Journal of Experimental Child Psychology,*105, pp. 213-231.

van den Boer, M., van Bergen, E. & de Jong, P. F., 2014. Underlying Skills of Oral and Silent Reading. *Journal od Experimental Child Psychology,*128, pp. 138-151.

van der Merwe, A., Roux, M.L., 2014. Idiosyncratic sound systems of the Bantu languages: Research and clinical implications for speech-language pathologists and audiologists. *South African Journal of Communication Disorders*, 61(11), pp. 1-8.

van Dulm, O., & Southwood, F. 2015. Child language assessment and intervention in multilingual and multicultural South Africa: Findings of a national survey. Stellenbosch Papers in Linguistics, 42, pp. 55 – 76.

Veii, K. & Everatt, J., 2005. Predictors of reading among Herero-English bilingual Namibian school children. *Bilingualism: Language and Cognition,* 8(3), pp. 239-254.

Wagner, R. K. & Torgesen, J. K., 1987. The nature of phonological processing and its causal role in the acquisition of reading skills. *Psychological Bulletin,* 101(2), pp. 192-212.

Wagner, R. K., Torgesen, J K., Laughon, P., Simmons, K., & Rashotte, C.A., 1993. Development of young readers phonological processing abilities. *Journal of Educational Psychology,* 85, pp. 83-103.

Wilsenach, C., 2013. Phonological Skills as predictor of reading success: an investigation of emergent bilingual Northern Sotho/English learners. *Per Linguam,* 29(2), pp. 17-32.

Wimmer, H., 2006. Don't neglect reading fluency! Commentary on Ziegler and Goswami (2006). *Developmental Science,* p. 447.

Wolf, M., 1991. Naming Speed and Reading: the contribution of the cognitive neurosciences. *Reading Research Quarterly,* 26(2), pp. 123-141.

Wolf, M. & Bowers, P. G., 1999. The double-deficit hypothesis for the developmental dyslexias. *Journal of Educational Psychology,* 91(3), pp. 415-438.

Wolf, M., Bowers, P. G. & Biddle, K., 2000. Naming-speed Processes, Timing and Reading: A Conceptual Review. *Journal of Learning Disabilities,* 33, pp. 387-407.

Yopp, H. K., 1988. The validity and reliability of phonemic awareness tests. *Reading Research Quarterly,* 23(2), pp. 159-177.

Zhang, J. & McBride-Chang, C., 2010. Auditory sensitivity, speech perception, and reading development and impairment. *Educational Psychology Review*, 22(3), pp. 323-338.

Ziegler, J., Bertrand, D., Toth, D., Csepe, V., Reis, A., Faisca, L., Saine, N., Lyytinen, H., Vaessen, A., & Blomert, L., 2010. Orthographic depth and its impact on universal predictors of reading: A cross-language investigation. *Psychological Science,*21(4) pp. 551-559.

Ziegler, J. C., Perry, C., Jacobs, A.M., & Braun, M., 2003. Developmental dyslexia in different languages: language-specific or universal?. *Journal of Experimental Child Psychology,* 86(3), pp. 169-193.

Ziegler, J. & Goswami, U., 2005. Reading acquisition, developmental dyslexia, and skilled reading across languages: a Psycholinguistic Grain-Size theory. *Psychological Bulletin,* 131(1), pp. 3-29.

Ziegler, J. & Goswami, U., 2006. Becoming literate in different languages: similar problems, different solutions. *Developmental Science*, 9(5), pp. 429-453.

Ziegler, J., Perry, C., Jacobs, A. & Braun, M., 2001. Identical words are read differently in different languages. *Psychological Science*, 12(5), pp. 379-384.

Zoccolotti, P., de Luca, M., di Pace, E., Gasperini, F., Judica, A., & Spinelli, D., 2005. Word length effect in early reading and in developmental dyslexia. *Brain and Language*, 93(3), pp. 369-373.

APPENDIX A: ORTHOGRAPHY-PHONOLOGY CORRESPONDENCES IN ISIXHOSA

The orthography-phonology correspondences are presented below for isiXhosa. These correspondence rules are found in the most authoritative dictionary of isiXhosa, the Greater Dictionary of isiXhosa (University of Fort Hare 1989). They are presented below according to their orthographic complexity which is my classification of the graphemes according to how many letters they consist of. These correspondences can be found in alphabetic order in the Greater Dictionary of isiXhosa (University of Fort Hare 1989: xlvii – lii). Graphemes which represent more than one phoneme are highlighted in grey shading.

Orthographic representation	**Phoneme**
Single letters	
a	[a]
b	[ɓ]
c	[ǀ]
d	[d̥]
e	[e]
	[ɛ]
f	[f]
g	[g̥]
h	[h]
	[ɦ]
i	[i]
j	[d̥͡ʒ̥]
k	[k’]
l	[l]
m	[m]
n	[n]
o	[o]
	[ɔ]
p	[p’]
q	[!]
r	[r]
s	[s]
t	[t’]
y	[u]
v	[v]
w	[w]
x	[ǁ]
y	[j]
z	[z]
Two letters	
Digraphs	
bh	[b̥]
ch	[ǀ^{h}]
dl	[ɮ]
dy	[ɟ̥]
dz	[d̥͡z̥]
gc	[ǀg̥]
gq	[!g̥]
gr (also a cluster)	[ɣ]
gx	[ǁg̥]
hl	[ɬ]
kc	[kǀ]
kh	[k^{h}]

kq	[k!]
kr (also a cluster)	[k͡x']
mb	[mb]
mf	[ɱɸf]
mh	[m^{ɦ}]
mv	[ɱβ͡v]
nc	[nǀ]
nd	[nd]
ng	[ŋg]
ng’	[ŋ]
nh	[n$^{ɦ]}$
nj	[^{n}d͡ʒ]
nk	[ŋk]
nq	[ŋ!]
nt	[^{n}t’]
nx	[ŋǁ]
ny	[ɲ]
nz	[^{n}d̥͡z̥]
ph	[p^{h}]
qh	[!$^{h]}$
rh	[x]
sh	[ʃ]
th	[t$^{h]}$
tl	[t͡ɬ’]
ts	[t͡s]
ty	[c']
wh	[w^{ɦ}]
xh	[ǁ^{h}]
yh	[j$^{ɦ]}$
zh	[ʒ]
Clusters with [w]	
cw	[ǀw]
dw	[dw]
nw	[nw]
qw	[!w]
sw	[sw]
xw	[ǁw]
gw	[gw]
lw	[lw]
yw	[jw]
zw	[zw]
Clusters with liquids [r] and [l]	
bl	[bl]
br	[br]
dr	[dr]
fl	[fl]
fr	[fr]
gl	[gl]
gr (also a digraph]	[gr]
kl	[kl]
kr (also a digraph)	[k’r]
sl	[sl]
tr	[tr]
Other clusters	
sk	[sk]
st	[st’]
Three letters	
Trigraphs	
ndl	[ndɮ]
ndy	[nɟ]
nkc	[nkǀ]
ndy	[ɲɟ]
ndl	[nd͡ɮ]
ngc	[ŋǀg]
ngq	[ŋ!g]
ngx	[nǁg]
nkc	[ŋkǀ]
nkq	[ŋk!]

nkx	[ŋkǁ]
ntl	[nt͡ɬ’]
nts	[nt͡s’]
nty	[nc’]
nyh	[ɲʱ]
ths	[t͡sʰ]
tsh	[t͡ʃ ’]
	[t͡ʃʰ]
tyh	[cʰ]
xhw	[ǁhw]
Clusters with [w]	
chw	[ǀʰw]
ndw	[ndw[
dlw	[ɮw]
drw	[drw]
ndw	[ndw]
dyw	[ɟw]
gcw	[ǀgw]
gqw	[!gw]
gxw	[ǁgw]
krw	[k͡xw]
ngw	[ŋgw]
ncw	[nǀw]
ndw	[ndw]
njw	[nd͡ʒw]
nkw	[ŋk’w]
nqw	[ŋ!w]
ntw	[nt’w]
nxw	[ŋǁw]
nyw	[ɲw]
nzw	[nd͡zw]
qhw	[!hw]

rhw	[xw]
shw	[ʃw]
skh	[skʰ]
thw	[thw]
tlw	[t͡ɬ’w]
tyw	[c’w]
Other clusters	
khr	[kʰr]
ndr	[ndr]
str	[st’r]
Four letters	
Quadgraphs	
ntsh	[nt͡ʃ ’]
Clusters with [w]	
ndlw	[nd͡ɮw]
ndyw	[ɲɟw]
ngcw	[ŋǀgw]
ngqw	[ŋ!gw]
ngxw	[nǁgw]
nkcw	[ŋkǀw]
nkqw	[ŋk!w]
nkxw	[ŋkǁw]
ntsw	[nt͡s’w]
ntyw	[nc’w]
nyhw	[ɲʱw]
tshw	[t͡ʃ ’w]
tyhw	[cʰw]
Five letters	
Cluster with [w]	
ntshw	[nt͡ʃ ’w]

APPENDIX B: RAN ADMINISTRATION INSTRUCTIONS

Instructions	English	Xhosa
Begin the audio recording	Now we are going to read some numbers.	Ngoku sizakufunda amanani.
Hold the single numbers out for the participant to see and touch if they want [all numbers are presented to avoid priming effects]. *If s/he doesn't know one of the numbers, tell them* (with the zi- prefix), *then go through all numbers again, if they still do not know them, do the test anyway*	Can you tell me, what are these numbers called in isiXhosa. For example, this number here (hold out the number) ,we call this two(zimbini). What are these numbers? 1, 5, 7, 2, 9, 3, 6, 4,8 Good. You know all of them.	Yitsho ukuba abizwa njani la manani ngesiXhosa. Umzekelo, (hold ou the number 2), ubizwa, zimbini. Athina la manani? 1, 5, 7, 2, 9, 3, 6, 4,8 Wenze kakuhle, uwazi onke.
Show them the practice board. Give it to them to hold in a comfortable and appropriate place on the desk	Here are the numbers. This is how we read the numbers:	Nanga ke amanani. Siwafunda ngoluhlobo:
As you read the instructions, indicate on the PRACTICE board how they should read, read through the first row with them	Read the numbers from the left to the right (*show them a 'fake board'*) as quickly as you can. when you finish the row, you can start at the next line straightaway. Remember, read as fast as you can in isiXHosa,	Funda ukusuka ekhohlo usinge ekunene ngesantya esikhawulezayo. Khawuleza, kodwa ungade ubhude ekuwabizeni amanani. Xa ugqiba umgca, sukuma,

	but you must still say the words properly.	gqithela kolandelayo.
Show them the stopwatch/timer so that they are comfortable with it.	I am going to time you.	Ndizakushicilela pantsi ixesha olithathileyo ukufunda.
Once they are ready, place the RAN test infront of them, covered up. Then uncover, make sure they pay attention to the first item of the first row. Begin the timer/stopwatch.	Ok. Are you ready?	Ingaba ukulungele ukuqalisa?
Start the timer once you say "begin". Ask them to stop reading once it has reached 15 secs and make a note of the last number they completed reading.	Read until I ask you to stop.	Funda ude uqhawulwe ndim.
Thank them for participating in this test.	Well done.	Wenze kakuhle.

APPENDIX C: RAN SCORE SHEET

2	6	9	4	7	**Participant code:** **Research Assistant:**
2	2	4	7	9	Did they know all the practice numbers? Y/N If not, which ones did they not know? (circle) 1 2 3 4 5 6 7 8 9
6	2	4	7	6	
9	4	7	2	6	**Scoring instructions:**
2	2	2	7	9	*Start the countdown when you ask them to start. 15 seconds long*
9	9	6	9	6	Circle the last number that they read within the time limit.
4	7	7	2	6	**How to indicate the incorrect reading** **Omissions:** put a – through the number, e.g. **Substitution:** squiggle underline and write the number they said instead e.g. instead of 9 they say 6 → 9 ⁶ **Missing syllables:** Underline e.g. 7 '[illegible]' they say '[illegible]' because they are rushing **English:** write an asterisk next to the number e.g. 6* if they say 'six'
9	6	9	9	2	
2	6	9	2	2	It's fine if you don't get to write down the errors during the test. BUT – **the final WHOLE number read is essential!** Pay attention, please.
7	7	2	4	6	
6	9	9	2	6	**Notes/Comments:** **Total Read:** **# Errors:**
2	2	7	6	9	
2	6	9	2	9	
7	4	7	9	6	
4	4	7	4	4	

APPENDIX D: PA TASK

General Instructions (*read these when you start the session)*

English	**Xhosa**
Hello	Molo
Today we are going to be playing a game with words	Namhlanje sizokudlala umdlalo wamagama.
It is not difficult and if you need anything to be repeated, you can just ask	Mo mdala akakhonzima ba ufuna uncedo uze ucele.
There is no right or wrong answer, we are just playing for fun	Ayikho impendulo eright okanye erongo, sidlala ubumnandi.
You are going to be told a word and then asked to do something to the word	Uzokunikwa igama wogqiba sizocela wenze into ngalo igama onikwe lona.
The words you will hear are made up words, so do not worry if you have never heard them before.	Lamagama uzowava awekho. Siwenze ngokwethu. Uzungakhathazeki ba awuwazi.
Record the participant's code and begin recording. Say the participant's code out loud so that it is recorded on the audio recorder.	

Remember:

- Say the codes of the participants at the beginning of the recording
- When the child repeats the nonsense word, make sure they are actually repeating it correctly
- After the child gives a response, please repeat EXACTLY what they said in a clear voice so that I can hear it on the recording.
- When the child gives an incorrect answer, reply as if they did it correctly e.g. "well done" or "yes"
- Please remember to use letter SOUNDS not NAMES. E.g. when explaining the first sound of 'xola' you don't say 'ex', pronounce the actual click sound that corresponds to that letter

Segmenting of syllables

English	Xhosa
Do you know what a tortoise is? And are tortoises fast or slow creatures?	Uyamazi uskolpati? Ooskolpati bayabaka okanye bayacotha?

They are slow. Did you know, because they walk so slowly, they have a special way of talking too?	Bayacotha. Buyazi ukuba ngenxa becotha, banendlela yokuthetha eyeyabo.
Let me give you an example.	Nanku umzekelo.
When a tortoise says “vumaka” they say it much slower. This is what they sound like.	Xa uskolpati esithi “vumaka” batsho becotha kakhulu. Bathetha elihlobo.
(show the segmentation by opening the tortoises mouth) “vu” “ma” “ka”	
Let’s do it together: Lets say “vumaka” like a tortoise would. “vu” “ma” “ka”	Masiyenze kunye. Masithi “vumaka” njengo skolpati. “vu” “ma” “ka”
Ok. Lets practice another one. If a tortoise wanted to say “bhefuza.	OK. Masiyekwakhona ngelinye igama. Masithi “bhefuza” njengo uskolpati.
The tortoise would say “bhe” “fu” “za”	Uskolpati angathi “bhe” “fu” “za”
Great, are you ready to try to speak like a tortoise now?	Uzokwazi ukuthetha njengoskolpati? Thatha wenze nawe.
Segmenting Stimuli	
Say ___ How would the tortoise say ____	Ithi ___ Angathini uskolpati xa enobiza igama elithi____?
Letshaya	Le-tsha-ya
Kralesa	Kra-le-sa
Zarheno	Za-rhe-no
Lotsesa	Lo-tse-sa
Culafa	Cu-la-fa
Qolotshasa	Qo-lo-tsha-sa
Lupiliza	Lu-pi-li-za
Kushaleka	Ku-sha-le-ka
Dlobiseka	Dlo-bi-se-ka
vulutehla	Vu-lu-te-hla

Identification of syllables

Do you know that game we play outside called hopscotch? That's great! We are going to play hopscotch with the sounds in words. In this game, we have to make BIG jumps to the right/correct sound in the word and say it.	Uyakwazi ukudlala umdlalo obizwa ngoSkotshi? Sizokudlala uskotshi sisebenzise amagama. Kulomdlalo funeka uxhume ngapha nangapha xa usiva igama elithile kwaye utsibe kakhulu xa usiva igama kwagqiba ulibize.
Let me give you an example	Mandikunike umzekelo.
I will ask you to say a word. Say 'bofuka'	Ndizocela ubize igama elithi "bofuka"
Now we must jump to the first sound in this word (repeat word)	Funeka sitsibele kwisandi sokuqala ku"bofuka"
The first sound is 'bo' Listen, "bo" "fu" "ka" (show on fingers, first, second, third)	Igama lokuqala ngu-"bo" Mamela, 'bo' 'fu' 'ka' (Show on firngers, first, second, third)
Great. Let's try another one	Kulungile ke, masizame elinye igama.
Say 'cifala'	Ithi 'cifala'
Jump to the second sound in the word, 'cifala'. What is it?	Tsibela kwisound yesibini kweligama lithi 'cifala', lithini?
Yes that is correct, it is 'fa'. Listen, "ci" "fa" "la" (indicate with fingers, first, second, third)	Heke, utichanile, ngu'fa'. Mamela 'ci' 'fa' 'la. (Show on fingers)
Great. we both know how to play the game. I am going to ask you to make BIG jumps to some more sounds in words. Are you ready?	Kulingile ke, siyakwazi ukudlala uskotshi wamagama. Ndizocela utsibe kakhulu kwamanye amagama njengoba senzile ngoku. Siye kwakhone?
Identification Stimuli	
Say ____ Now, Jump to the first sound in _____ Now, Jump to the second sound in ____ Now, Jump to the (last) sound in ____ What is the sound?	Ithi____ Tsibela kwi-ndawo yokuqala kweli gama____ Tsibela kwi-ndawo yesibini ku_____ Tsibela kwindawo yokugqibela ku___ Lithini igama xa ulibiza ngezi ndawo?

Asked for:	Presented with:	Correct response:
2.2. Jump to the first sound:	junala	Ju
2.3. Jump to the first sound	temala	Te
2.4. Jump to the last sound:	bontuka	Ka
2.5. Jump to the second sound:	nilema	Le
2.6. Jump to the second sound:	zatila	Ti
2.7. Jump to the last sound:	Sukiba	Ba
2.8. Jump to the second sound:	Zuwala	Wa
2.9. Jump to the last sound:	Rhivaqa	Qa
2.10. Jump to the first sound	Hlevasha	Hle
2.11. Jump to the last sound:	fumeta	Ta

Deletion of Syllables

For this game that we are going to play, we are going to say some secret passwords. We are going to say a word, and then we change the word to give us the password.	Kulo umdlalo kengoku sizokukhangela amagama fihlekileyo. Sizokubiza igama sithi sogqiba sitshintshe igama kuze sifumane elifihlekileyo.
Let me give you an example	Mandikunuke umzekelo.
I will ask you to say a word. Say ‘pemika’	Ndizokucela ubize igama elithi ‘pemika’
Now say ‘pemika’ without ‘pe’	Buza u’pemika’ ungabizanga u”pe”
The password is ‘mika’ ‘pemika’ without ‘pe’ is ‘mika’	Igama elifihliweyo ngu’mika’. U”pemika” ongena “he” ekugaleni ngu ‘mika’
Great. Let’s try another one	Kulingile, masizame elinye igama.
Say ‘fitshula’	Biza u’fitshula’
Say ‘fitshula’ without ‘tshu’	Biza u’fitshula’ ongena ‘tshu’.
Yes that is correct, it is ‘fila’. “fitshula’ without ‘tshu’ is fila	Ulichanile, igama ngu’fila. U’fitshala’ ongena ‘tshu’, ngu’fila’
Great. we both know how to play the game to make passwords.	Kulingile ke siyakwazi ukudlaa kunye ukhukhangela amagama afihliweyo.

I am going to ask you to find some more secret words Are you ready?	Ndizokucela undikhangele amanye amagama afihliweyo. Siyekwakhona?
Deletion Stimuli	
Say _____ Now say _____ without _____ What is the password?	Ithi ___ Ngoku ithi ___ ngaphandle ko_____ Lithini igama elifihliweyo?
2.12. Setika - se	tika
2.13. Torhale - le	Torha
2.14. Rhawelo - rha	welo
2.15. Tyigeno - no	tyige
2.16. Pelaza - la	Peza
2.17. Xolinga - li	Xoga
2.18. Bhubeka - be	Bhuka
2.19. Ncowula - nco	Wula
2.20. Pizila - zi	Pila
2.21. Qofoshi - shi	Qofo

Segmenting of Phonemes

English	Xhosa
Do you know what a robot is? Yes, it's a man made of metal. Do you know what they sound like when they speak? they talk funny. In this game with words, we are going to speak like robots.	Uyayazi yintoni iRobot? Ngunodali owenzwe ngecangi. Uyayazi bathetha njani? Bathetha snaksi. Kulo mdlalo sizothetha nje ngeRobot.
When robots speak, they say each little sound in a word, because ti is difficult to say the whole word. Let me give you an example.	Xa zithetha iiRobor zibiza igama ingathi liqhekeziwe. Nanku Umzekelo.
When a robot says a word like "foma" they say	Xa iRbot Ibiza igama elinje ngo-"foma"

it like this ‘f’ ‘o’ ‘m’ ‘a’.	zithi “f” “o” “m” “a”.
Another example, when a robot says ‘nosa’ they break up the word and say ‘n’ ‘o’ ‘s’ ‘a’	Omnye umzekelo, xa irobot isithi “nosa” ziyalophula igama eli uhloba.
Let’s do ‘nosa’ together like a robot would say it. ‘n’ ‘o’ ‘s’ ‘a’	Masenze u”nosa” kinye nje nge-robot. “n” “o” “s” “a”
Great, are you ready to try to speak like a robot now?	Heke, uzokwazi ukuthetha nje nge-robot ngoku?
Segmenting Stimuli	
Say ____ How would the robot say ____	Ithi____ iRobot angalibiza njani igama elithi___?
2.22. Tuza	t-u-z-a
2.23. Gcena	Gc-e-n-a
2.24. hlama	Hl-a-m-a
2.25. Cakra	C-a-kr-a
2.26. foma	f-o-m-a
2.27. Gofotsa	g-o-f-o-ts-a
2.28. Rhagone	Rh-a-g-o-n-e
2.29. dopike	d-o-p-i-k-e
2.30. samatse	s-a-m-a-ts-e
2.31. gefina	g-e-f-i-n-a

Identification of Phonemes

Do you know that game we play outside called hopscotch? That’s great! We are going to play hopscotch with the sounds in words. In this game, we have to make SMALL jumps to the right/correct sound in the word and say it.	Uyakwazi ukudlala umdlalo obizwa ngoSkotshi? Sizokudlala uskotshi sisebenzise amagama. Kulomdlalo funeka uxhume ngapha nangapha xa usiva igama elithile kwaye utsibe kancinci xa usiva igama kwagqiba ulibize.
Let me give you an example	Mandikunike umzekelo.
I will ask you to say a word. Say ‘shama’	Ndizocela ubize igama elithi “shama”
Now we must jump to the first sound in this word? (repeat word)	Funeka sitsibele kwigaa lokuqala ku”shama”

The first sound is ‘sh’ Listen, “sh” “a” “m” “a” (show on fingers, first, second, third, fourth, really prolong the sound)	Igama lokuqala ngu-“bo” Mamela, “sh” “a” “m” “a” (Show on firngers, first, second, third etc)
Great. Let’s try another one	Kulungile ke, masizame elinye igama.
Say ‘xola’	Ithi ‘xola’
Jump to the second sound in the word, ‘xola’. What is it?	Tsibela kwisound yesibini kweligama lithi ‘xola’, lithini?
Yes that is correct, it is ‘o’. Listen, “x” “o” “l” “a” (indicate with fingers, first, second, third, fourth)	Heke, utichanile, ngu’fa’. Mamela ‘x’ ‘o’ ‘l’ ‘a’. (Show on fingers)
Great. we both know how to play the game. I am going to ask you to make small jumps to some more sounds in words. Are you ready?	Kulingile ke, siyakwazi ukudlala uskotshi wamagama. Ndizocela utsibe kancinci kwamanye amagama njengoba senzile ngoku. Siye kwakhone?

Identification Stimuli		
Say ____ Now, Jump to the first sound in _____ Now, Jump to the second sound in ____ Now, Jump to the third sound in ____ What is the sound?	Ithi____ Tsibela kwi-ndawo yokuqala kweli gama____ Tsibela kwi-ndawo yesibini ku_____ Tsibela kwindawo yesithathu ku___ Lithini igama xa ulibiza ngezi zandi?	
2.32. What is the first sound:	Werhata	W
2.33. What is the third sound:	Vamala	m
2.34. What is the first sound:	kolohla	K
2.35. What is the second sound:	leyisa	E
2.36. What is the second sound:	tolega	o
2.37. What is the third sound:	cufasa	f
2.38. What is the first sound in:	Tyizena	Ty
2.39. What is the third sound:	civuke	v
2.40. What is the second sound:	turhoza	u
2.41. What is the third sound:	tuzugo	z

Deletion of phonemes

For this game that we are going to play, we are going to find some secret passwords. We are going to say a word, and then we change the word to give us the password.	Kulo umdlalo kengoku sizokukhangela amagama fihlekileyo. Sizokubiza igama sithi sogqiba sitshintshe igama kuze sifumane elifihlekileyo.
Let me give you an example	Mandikunuke umzekelo.
I will ask you to say a word. Say ‘dlula’	Ndizokucela ubize igama elithi ‘dlula’
Now say ‘dlula’ without ‘dl’	Buza u’dlula’ ungabizanga u”dl”
It is ‘ula’ ‘dlula’ without ‘dl’ is ‘ula’	Igama elifihliweyo ngu’ula’. U”dlula” ongena “dl” ekugaleni ngu ‘ula’
Great. Let’s try another one	Kulingile, masizame elinye igama.
Say ‘tsifa’	Biza u’tsifa’
Say ‘tsifa’ without ‘ts’	Biza u’ts’ ongena ‘ifa’.
Yes that is correct, it is ‘ifa’. “tsifa’ without ‘ts’ is ‘ifa’	Ulichanile, igama ngu’ifa’. U’tsifa’ ongena ‘ts’, ngu’ifa’
Great. we both know how to play the game. I am going to ask you to find some more secret words Are you ready?	Kulingile ke siyakwazi ukudlala kunye ukhukhangela amagama afihliweyo. Ndizokucela undikhangele amanye amagama afihliweyo. Siyekwakhona?
Deletion Stimuli	
Say ____ Now say ____ without ____ What is the password?	Ithi ___ Ngoku ithi ___ ngaphandle ko____ Lithini igama elifihliweyo?
2.42. Qetaza - q	Etaza
2.43. Dlashaza - dl	Ashaza
2.44. Gomveni - g	Omveni
2.45. Logeka - l	Ogeka
2.46. Hlenama - hl	Enama
2.47. Bocena - b	Ocean
2.48. Mekuma - m	Ekuma
2.49. Tsilaba - ts	Ilaba
2.50. Tshafiba - tsh	Afiba
2.51. Lutsiba - l	utsiba

APPENDIX E: ORAL READING FLUENCY TASK INSTRUCTIONS

English	Xhosa
Record the participant's code on the marking sheet. *Switch on the recorder. Make sure you say the participants code out loud so that it is available on the recording as well.*	
Read the instructions to the child. Passage is covered with a piece of paper.	
Now we are going to do some reading.	Ngoku sizakufunda.
I am going to ask you to read me a very interesting short story. The story is called <u>iSikhitshana somLingo (The Magic Boat).</u> Please can you read the story to me as if you are reading aloud in your best voice. Also remember to listen to what you are reading because I am going to ask you some questions afterwards.	Ndizakukucela undifundele ibali elifutshane elinika umdla. Eli bali lithi "iSkitshana somLingo". Ndicela undifundele eli bali ngokungathi ufundela ngaphandle ngelona ilizwi lakho. Yimamele lento uyifundayo kuba uza kubuzwa imibuzo xa ugqibile.
You can use your finger to keep your place. If you come to a word you don't know, try to read it, and if you need help, I will help you.	Ukuba udibana negama ongalaziyo, zama ukulifunda. Ukuba uxakiwe ndizakukunceda. Ungasebenzisa umnwe wakho ukugcina indawo ophele kuyo.
I am going to ask you to start at the top, by the title, and read until I ask you to stop. Do you have any questions? Great. Are you ready?	Ndifuna uqale phezulu ngesihloko, kwaye ufunde ude unqandwe ndim. Ingaba unawo umbuzo? Kuhle ke. Ukulungele na ukuqalisa?
Please start here at the title of the story then carry on reading the rest in your best way of reading.	Qala esihlokweni sebali uqhube ufunda ngolona hlobo ukwazi ngalo.
Ready? Remember to start here *(indicate title)*	Ukulindele ukuqala? Ukukhumbule ukuqala kule ndawo.
Start the stopwatch when participant begins to read	

You may score the test while the participant is reading, but remain conscious of the time. If they struggle with a word for 3 secs please do help them	
After one minute, say "stop" *and* *place a bracket* *( ]) next to the last word read (on the marking sheet). Then say to the student, "*Thank you for reading."	Pheza. Enkosi ngokufunda.

APPENDIX F: ORAL READING TEXT

<u>iSikhitshana somLingo</u>

Kudaladala, kwaye kukho ixhegwazana elisisilumko nelinobubele kakhulu. Lalihlala kwisiqithi esasiphakathi kulambokazi iNciba.

Xa abantu belali ekufutshane nendawo elihlala kuyo belamba, belibaphathela iintlanzi. Bebelibulela kakhulu baze balimeme ukuba lize kutya nabo. Kodwa lona belisala.

Inkosi yelali leyo yayinomona kwaye izidla.
“Ungubani na wena?” imnkqanigise yatsho. “Usuka phi na khona? Kwaye kutheni le nto ndingaqalanga ndaphakelwa kuqala?”
Ixhegwazana eli lisuke nje lazincumela, laza lakwela kwisikhitshana salo laza langena phakathi lihamba ngomlambo lowo.

Le nto yayicaphukisa kakhulu inkosi, ngoku ke yaya yayilandela le nkondekazi. Inkosi ihambe iiyure ezinzi yaza ekugqibeleni yasibona isiqitha esiphakathi emlanjeni. Nantso le nkondekazi isehla kwisikhitshana salo, yaza yangena ngaphakathi endlwini. Inkosi iye yalalisela apho igade eli xhegwazana.

APPENDIX G: SILENT READING TASK INSTRUCTIONS

English	Xhosa
Record the participant's code on the marking sheet. *Switch on the recorder. Make sure you say the participants code out loud so that it is available on the recording as well.*	
Read the instructions to the child. Passage is covered with a piece of paper.	
Now we are going to do some reading.	Ngoku sizakufunda.
I am going to ask you to read me a very interesting short story. The story is called <u>The old men who went knocking (Linkonde ziyankqonkqoza).</u> Please can you read the story to me as if you are reading aloud in your best voice. Also remember to listen to what you are reading because I am going to ask you some questions afterwards.	Ndizakukucela undifundele ibali elifutshane elinika umdla. Eli bali lithi "Iinkonde Ziyankqnkqoza. Ndicela undifundele eli bali ngokungathi ufundela ngaphandle ngelona ilizwi lakho. Yimamele lento uyifundayo kuba uza kubuzwa imibuzo xa ugqibile.
You can use your finger to keep your place. If you come to a word you don't know, try to read it, and if you need help, I will help you.	Ukuba udibana negama ongalaziyo, zama ukulifunda. Ukuba uxakiwe ndizakukunceda. Ungasebenzisa umnwe wakho ukugcina indawo ophele kuyo.
I am going to ask you to start at the top, by the title, and read until I ask you to stop. Do you have any questions? Great. Are you ready?	Ndifuna uqale phezulu ngesihloko, kwaye ufunde ude unqandwe ndim. Ingaba unawo umbuzo? Kuhle ke. Ukulungele na ukuqalisa?
Please start here at the title of the story then carry on reading the rest in your best way of reading.	Qala esihlokweni sebali uqhube ufunda ngolona hlobo ukwazi ngalo.
Remember to start here *(indicate title)* and to use your finger to show me what you are reading	Ungalibali ukuqala kule ndawo kwaye uhlale ukhamba apho ufunda khona.

Ready? Begin reading.	Qalisa ukufunda.
Start the stopwatch when participant begins to read	
After one minute, say "stop". *Ask the child to indicate their last word read.* P*lace a bracket ( ]) next to the last word read (on the marking sheet). Then say to the student*, "Thank you for reading."	Pheza. Enkosi ngokufunda.

APPENDIX H: SILENT READING TEXT

Linkonde ziyankqonkqoza

Kwakusekusasa kakhulu kwaye kusemnyama. Kuthe gqi izithunzi ezithathu zithe chu kancinane, zithoba indlela, zisingise elalini. Zema phambi komzi othile zaza zankqonkqoza emnyango.

Ngaphakathi endlwini, usapho lwaluvukile luthe qwa. Abantwana babethetha kwaye becula ngamazwi amakhulu, lo gama umama wabo wayepheka isidlo sakusasa. Kwathi kwakuba kuvuthiwe ukutya, usapho olulambileyo lwahlala phantsi lwathi nqwadalala, lwatya. Kube ngaloo mzuzu kuphela abathi beva ngawo ukunkqonkqozwa kwasemnyango.

Umama uye efestileni waza wakroba. Ngoku izithunzi zazisele ziphelile, nto leyo eyenze ukuba azibone ezo nkonde zilindile phandle.

Kukho iinkonde ezintathu apha phandle," uxelele utata. "Zimdaka kwaye zilambile, zifuna ukuncedwa."

"Kaloku kufuneka uzivulele, uzimeme zingene ngaphakathi," uthsilo umnyeni wakhe.

Kwa oko umama waya emnyango waza wazimema ezo nkonde ukuba zingene ngaphakathi.

APPENDIX I: SPELLING ANSWER SHEET FOR PARTICIPANTS

Igama lamngu_______________________________

	Phendula	
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		
11.		
12.		
13.		
14.		
15.		