PHONOLOGICAL PROCESSING SKILLS AND THEIR LONGITUDINAL RELATION TO FIRST AND ADDITIONAL LANGUAGE LITERACY IN ISIXHOSA AND ISIZULU SPEAKING CHILDREN

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I declare that the above thesis is my own work and that all the sources that I have used or quoted have been indicated and acknowledged by means of complete references.

I further declare that I submitted the thesis to originality checking software and that it falls within the accepted requirements for originality.

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ABSTRACT AND KEY TERMS

Phonological awareness (PA), rapid automatised naming (RAN), and phonological working memory (PWM) are phonological processing skills which support literacy development concurrently and longitudinally. For bilinguals, skills developed in the first language (L1) can support literacy development in the additional language in a process called transfer. Phonological processing skills and their role in the literacy development of emergent bilinguals in the South African context has been under-explored. This study aimed to determine the within-language and across-language longitudinal development of, and association between, phonological processing skills and literacy skills of children who use two closely related African languages and English from Grades 1 to 3. A group of isiXhosa-English (n = 69) and isiZulu-English (n = 70) emergent bilingual children completed L1 and English phonological processing and literacy (letter recognition fluency, word and text reading fluency, spelling) measures at three points in time: the end of Grade 1 (t1), start of Grade 3 (t2), and end of Grade 3 (t3). Reading comprehension was assessed at t3 only. Confirmatory factor analysis models revealed that PA was best conceptualised as two language specific latent factors at t1, but as a language general factor at t2. PWM and RAN were best conceptualised as language general factors at t1 and t2. Path models on the cross-sectional data revealed that letter recognition fluency and PA were predictors of literacy, but the effect of RAN on literacy was mediated via letter recognition fluency, suggesting that RAN reflects the ability to make orthography-phonology correspondences. At early stages of reading development (t1), when PA and letter knowledge were not well-established, PWM (digit span) was a more stable predictor of later literacy attainment. Once letter knowledge was developed and PA skills were stronger (t2), the data replicated what has been found for other contexts: PA is a stable predictor of later L1 and English literacy, and alphanumeric RAN contributed to reading fluency (in L1). This study confirms the importance of teaching letter-sound correspondence rules to high levels of accuracy in the first grade in the South African context. Furthermore, automaticity in decoding needs to be prioritised in young readers to support reading fluency and comprehension.

Key terms: Phonological processing; Phonological awareness; Rapid automatised naming; Phonological working memory; Reading fluency; Reading comprehension; Spelling; Cross-linguistic transfer; Literacy development; Emergent bilingual.

OPSOMMING EN SLEUTELWOORDE

Fonologiese bewussyn, snelle geoutomatiseerde benoeming en fonologiese werkgeheue is fonologiese verwerkingsvaardighede wat die ontwikkeling van geletterdheid gelyktydig, sowel as longitudinaal, ondersteun. In tweetalige leerders kan vaardighede wat in die eerste taal ontwikkel geletterdheidsontwikkeling in 'n addisionele taal ondersteun, deur 'n proses bekend as 'kruislinguistiese oordrag'. Die relatiewe rol wat verskillende fonologiese verwerkingsvaardighede in die ontwikkeling van geletterdheid in ontluikende tweetalige kinders speel is egter nie duidelik in die Suid-Afrikaanse konteks nie. Hierdie studie het ten doel om die longitudinale ontwikkeling van, en korrelasie tussen, fonologiese verwerkingsvaardighede en geletterdheidsvaardighede te ondersoek in kinders wat in 'n Afrika taal en Engels leer lees van graad 1 tot graad 3. 'n Groep isiXhosa-Engels (aantal = 69) en isiZulu-Engels (aantal = 70) ontluikende tweetalige kinders het fonologiese verwerkingsvaardighede toetse en geletterdheidsvaardighede (letterherkenningvlotheid, woord- en teksleesvlotheid, spelling) toetse in sowel die eerste taal as in Engels voltooi. Alle leerders is op drie tydstippe geassesseer: einde van graad 1 (t1), begin van graad 3 (t2), en einde van graad 3 (t3). Leesbegrip is slegs tydens t3 getoets. Bevestigende faktor ontledingsmodelle het aangedui dat fonologiese bewussyn as twee taalspesifieke latente faktore by t1, maar as 'n taal-algemene faktor by t2 gekonseptualiseer moet word. Daarteenoor kon fonologiese werkgeheue en snelle geoutomatiseerde benoeming as taal-algemene faktore by sowel t1 as t2 gekonseptualiseer word. Statistiese modelle van die deursnit-data het aangetoon dat die vlotheid waarmee leerders letters herken, sowel as die vlak van fonologiese bewussyn, geletterdheid direk voorspel, maar dat die effek van snelle geoutomatiseerde benoeming op geletterdheid deur die vlotheid van letterherkenning bemiddel word. Dit suggereer dat snelle geoutomatiseerde benoeming die vermoë weerspieël om verbintenisse tussen die ortografie en fonologie van 'n taal te maak. Tydens t1, waar fonologiese bewussyn en letterkennis nog nie na behore ontwikkel was nie, het fonologiese werkgeheue (syferspan) latere geletterdheidsvlakke beter voorspel. Tydens t2, waar letterkennis en fonologiese bewussyn meer gevestig was, het die data vroeëre bevindings uit ander kontekste (naamlik dat fonologiese bewussyn 'n stabiele voorspeller is van latere eerstetaal en addisionele taal geletterdheid) ondersteun. Snelle geoutomatiseerde benoeming het met name bygedra tot leesvlotheid (in die eerste taal). Hierdie studie bevestig die noodsaak om letter-klank korrespondensiereëls in die eerste graad in die Suid-Afrikaanse konteks deeglik te onderrig, sodat hoë vlakke van akkuraatheid vroeg bereik word. Verder moet outomatisiteit in dekodering by jong lesers geprioritiseer word om leesvlotheid en -begrip te ondersteun.

Sleutelterme: Fonologiese verwerking; Fonologiese bewustheid; Snelle outomatiese benoeming; Fonologiese werkgeheue; Leesvlotheid; Leesbegrip; Spelling; Kruislinguistiese oordrag; Geletterdheidsontwikkeling; Ontluikende tweetaligheid.

ISISISHWANKATHELO KUNYE NAMAGAMA ANGUNDOQO

Ulwazi lwefonoloji (*PA*), ukubiza/ukufunda izinto ezisondeleneyo ngokukhawuleza nangokuzenzekela okwaziwa ngokuba yi-*rapid automatised naming* (*RAN*), kunye nenkqubo yokukhumbula ngokukhawuleza ukusebenza kwefonoloji eyaziwa ngokuba yi-*phonological working memory* (*PWM*) zizakhono zocwangciso lwefonoloji ezixhasa uphuhliso lokufunda nokubhala ngokunqamlezileyo nangokobude ukusuka entla ukuya ezantsi. Kwabo abathetha iilwimi ezimbini, izakhono eziphuhliswe ngolwimi lokuqala (*L1*) zinako ukuxhasa uphuhliso lwesakhono sokufunda nokubhala ngolwimi lwesibini kwinkqubo ebizwa ngokuba kukufunda ulwimi ngokolwazi lolunye ulwimi. Lunqongophele uphando lwezakhono zocwangciso lwefonoloji kunye nendima yazo ekuphuhliseni isakhono sokufunda nokubhala kwabo abaqhuba bephuhlisa ulwimi lwabo lwasekhaya ngelixa befunda ulwimi lwesibini kwimeko yoMzantsi Afrika. Olu phando belujolise ekufumaneni uphuhliso kulwimi ngalunye kunye nokunxulumana kubudlelwane phakathi kwizakhono zokwaziswa kwefonoloji kunye nezakhono zokufunda nokubhala kubantwana abasebenzisa iilwimi ezimbini ezisondeleleneyo zesiNtu kunye nesiNgesi ukususela kumaBanga 1 ukuya kwele3. Iqela lesiXhosa nesiNgesi (*n = 69*) kunye nesiZulu nesiNgesi (*n = 70*) labantwana abaqhuba bephuhlisa ulwimi lwabo lwasekhaya ngelixa befunda ulwimi lwesibini ligqibe i-*L1* kunye nemilinganiselo yocwangciso nokubhalwa kwefonoloji yesiNgesi (ukuqaphela oonobumba kakuhle, ukuqaphela amagama kunye nokufunda umbhalo kakuhle, upelo) ngamanqaku amathathu ngexesha: ekupheleni kweBanga 1 (*t1*), ekuqaleni kweBanga 3 (*t2*), kunye nasekupheleni kweBanga 3 (*t3*). Kuvavanywe i-*t3* kuphela ukuze kujongwe ukuqonda kwabo oko kubhaliweyo. Iimodeli zohlalutyo lomsantsa okhoyo (*confirmatory factor analysis models*) phakathi komba ophandwayo nethiyori zibonise ukuba i-*PA* iye yaqingqwa kakuhle kakhulu njengemiba emibini ethile yolwimi engekaphuhliswa kwi-*t1*, kodwa ibe ngumba wolwimi oqhelekileyo kwi-*t2*. I-*PWM* ne-*RAN* zezona ezithe zaqingqwa kakuhle kakhulu njengemiba eqhelekileyo yolwimi kwi-*t1* nakwi-*t2*. Iimodeli zobudlelwane obunxulumeneyo phakathi kwezinto eziguqaguqukayo nezo ezingaguquguqukiyo kwidatha evela kuluntu ngexesha elinye zivelise ukuba ukuqatshelwa kakuhle koonobumba kunye ne-*PA* zezona zinto eziqikelela izakhono zokufunda nokubhala kodwa ifuthe le-*RAN* kwizakhono zokufunda nokubhala zingenelelwe ngokuqatshelwa kakuhle koonobumba, nto leyo echaza ukuba i-*RAN* ibonisa ukubanako kwabafundi ukwenza ungqinelwano kwimigaqo yokubhala nefonoloji. I-*PWM* (ukugcinwa kolwazi okwethutyana) ibingumqikeleli ozinzileyo wokufikelela kwisakhono sokufunda nokubhala samva kwizigaba zokuqala zophuhliso lokufunda (t1), ngelixa i-*PA* kunye nolwazi

loonobumba zingakhange zimiselwe kakuhle. Lwakuba ulwazi loonobumba luphuhlisiwe nezakhono ze-*PA* zomelele (*t2*), idatha iphinde yaphindaphinda oko kuye kwafunyanwa kwezinye iimeko: I-*PA* ngumqikeleli ozinzileyo we-*L1* yamva kunye nesakhono sokufunda nokubhala isiNgesi, kwaye i- *RAN* equlethe oonobumba namanani ibe negalelo ekufundeni kakuhle (kwi-*L1*). Olu phando luqinisekisa ukubaluleka kokufundisa imithetho yongqinelwano lwezandi zoonobumba kumanqanaba okuchaneka aphezulu kwibanga lokuqala kwimeko yoMzantsi Afrika. Ngaphezu koko, ukuzenzekela kokukhupha izandi zoonobumba nokuqonda amagama abawakhayo kufuneka kubekwe phambili kubafundi abatsha ukuxhasa ukufunda kakuhle kunye nokuqonda oko kufundwayo.

Amagama angundoqo: Uveliso lwefonoloji (*Phonological processing*); Ukwaziswa kwefonoloji (*Phonological awareness*); Ukubiza/ukufunda ngokukhawuleza nangokuzenzekela (*Rapid automatised naming*); Inkqubo yokukhumbula ngokukhawuleza nokusebenza kwefonoloji (*Phonological working memory*); Ukufunda kakuhle; Ukufunda ngokuqonda oko kubhaliweyo; Upelo; Ukukhuphela ulwimi ngotshintshiselwano (*Cross-linguistic transfer*); Uphuhliso lwesakhono sokufunda nokubhala; Abo abaqhubeka bephuhlisa ulwimi lwabo lwasekhaya ngelixa bephuhlisa ulwimi lwesibini (*Emergent bilingual*).

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Abbreviation	Term	Notes
CTOPP	Comprehensive Test of Phonological Processes	
cw	Correct words	
cwpm	Correct words per minute	
DBE	Department of Basic Education (South Africa)	
DTWRP	Diagnostic Test of Word Reading Processes	
EFAL	English as First Additional Language	Name of a subject in South Africa.
EGRA	Early Grade Reading Assessment	
EGRS 1	First Early Grade Reading Study	Intervention to support L1 Setswana reading instruction
EGRS 2	Second Early Grade Reading Study	Intervention to support L2 English reading instruction
FAL	First additional language	Name of a subject in South Africa, language to be specified.
HL	Home language	Name of a subject in South Africa.
L1	First language	
L2	Second language	
lcpm	Letters correct per minute	
LoLT	Language of Learning and Teaching	Can also be considered the medium of instruction (MOI).
LRF	Letter recognition fluency	
MOI	Medium of Instruction	More often referred to as Language of Learning and Teaching (LoLT) in South Africa
NWR	Nonword repetition	
PA	Phonological awareness	
PIRLS	Progress in International Reading and Literacy Study	
PPVT	Peabody Picture Vocabulary Test	
PWM	Phonological working memory	
RAN	Rapid automatised naming	
SDG	Sustainable development goal	

“The story of learning to read is thus one of universals and particulars: Universals because writing maps onto language, no matter the details of the system; particulars, because it does matter how different levels of language – morphemes, syllables, phonemes – are engaged. And this in turn depends on the structure of the language and how its written form accommodates this structure.”

(Perfetti & Verhoeven, 2017, p. 465)

1 Chapter 1. Introduction

1.1 INTRODUCTION

The "science of reading" is a term used to describe the accumulated knowledge based on the scientific method about how people learn to read, how skilled reading develops over time, what causes reading problems and how reading should be taught (Petscher et al., 2020; Seidenberg, 2013). Reading, here, refers both to decoding (converting the letters within a word to its sounds to identify the word), word recognition (automatic recognition of words through orthographic processes) and reading comprehension (the ability to understand a text). Decoding and word recognition have received the most attention to date (Shanahan, 2020). Writing is an area related to reading and relies on an understanding of how language is encoded in print. Together, they are referred to as literacy. This view of literacy focusses on the level of the individual and their individual cognitive processes involved in reading and writing (Hedgcock & Ferris, 2018; Yaden et al., 2021).

Literacy can also be conceptualised more broadly as including socio-cultural dimensions (Yaden et al., 2021). For example, in New Literacy Studies, literacy is thought of as sociocultural activities i.e. ways of transmitting and understanding meaning within particular social and cultural environments (Gee, 1999, 2010). In this view, literacy is a mental as well as a social or cultural practice (Gee, 2010); because of these different socio-cultural situations, different literacies (or practices) arise for particular situations. For example, emergent literacy refers to the practices children engage in related to reading and writing, such as listening to storybook reading, talking about texts, as well as emergent writing and invented spelling before they start school (Ntuli & Pretorius, 2005). Children are not yet formally reading or writing but are engaging in practices within their social and educational environments that prepare them for school based literacies (Gee, 1999). Digital literacies have become essential in the current fourth industrial revolution. Digital literacies refer to the ways that people use, create and learn from digital texts and devices, and require critical evaluation of digital content (Hedgcock & Ferris, 2018). Other literacies people participate in include academic literacy, financial literacy, media literacy, scientific literacy and workplace literacy, among others (Hedgcock & Ferris, 2018). The home, community, schools and workplaces become sites for enculturation into various literacy practices (Pretorius & Machet, 2004). For the purposes of this thesis, I have limited the scope to primarily viewing literacy as a mental process of learning to read and write. Nevertheless, I do not ignore social and cultural aspects of literacy practice and address some aspects of home literacy practice such as exposure to and use of books between children and their caregivers. More detailed information about the role of social and cultural practices is outside the scope of this thesis.

From the view of literacy as a mental process, both reading and writing rely on children's understanding of how their spoken language (phonological and semantic information) is mapped onto written language (Perfetti & Verhoeven, 2017; Seidenberg, 2013). For reading in alphabetically written languages, children need to learn that phonemes are mapped onto letters, and children who learn to read in more than one language have to learn that the consistency of this mapping process may differ within and across languages (Bialystok, 2007; Ziegler & Goswami, 2005).

Proponents of the science of reading tend to examine the cognitive mechanisms of reading from a (post-) positivist deductive research approach (Petscher et al., 2020; Shanahan, 2020). The goal of the science of reading has been to determine whether there are universals of reading development which apply to all languages and writing systems and to differentiate these from aspects which are particular to a certain language or writing system (Seidenberg, 2013). Empirical evidence arising from the scientific method has been used to develop models and theories which are tested on new data or through simulation studies. The examination of the same constructs in different contexts, languages and samples over time contributes to an understanding of the universal mechanisms related to reading, and those particular to each language and/or writing system.

The research on alphabetic writing systems converges to show that phonological processing (including phonological awareness (PA), phonological working memory (PWM) and rapid automatised naming (RAN)) is required to read in such systems (Araújo et al., 2015; Melby-Lervåg et al., 2012). In addition, vocabulary knowledge and morphological processing are essential for word reading (since they contribute to lexical quality) and for reading comprehension (which relies on the access to semantic information in a text) (Kim, 2020b). The science of reading has been criticised for its historic focus on alphabetically written languages, specifically English and other European languages (Daniels & Share, 2018; Share, 2008, 2021) which has, to some extent, reduced knowledge of the particulars which affect reading development in other languages. Many languages from Africa are written alphabetically, but research on reading and the cognitive-linguistic skills related to reading in these languages is under-represented (Landerl et al., 2022; Perfetti & Verhoeven, 2017).

Another criticism of the science of reading has been the focus on monolingual rather than bi- or multilingual readers (Share, 2021). The reading development of bilingual readers has been treated as monolingual reading development in each language, rather than multilingual readers drawing on their multiple cognitive and language resources to read in either language (Cummins, 2017; O. García & Kleifgen, 2020). The research shows that the reading development of bilinguals can differ from their monolingual counterparts because (i) the cognitive-linguistic skills that support reading develop at different rates in bilinguals, compared to monolinguals, and (ii) bilingual readers can transfer their cognitive-linguistic and reading skills across languages (Bialystok et al., 2005). Thus, it is a simplification not to consider how bilingual status affects reading acquisition and development.

In light of the under-representation of African languages, and bilingual African language readers in the scientific study of reading, the current study documents the longitudinal development of cognitive-linguistic, reading and writing skills for two samples of children in South Africa. Specifically, the phonological processing, vocabulary, reading and spelling of a group of isiXhosa-English and a group of isiZulu-English emergent bilingual children will be compared. These two groups of children use and are learning to read in very closely related Nguni languages so it is expected that they would have similar developmental trajectories. This chapter introduces the South African educational context in which African language speaking children need to become bilingual and biliterate in their first language (L1) and English to succeed academically. The specific research problem of a lack of understanding of the development of cognitive-linguistic and reading skills of bilingual children in South Africa is addressed in more detail. Thereafter, the present study's aims and its scope are presented. The research questions and hypotheses of the study follow, and the research method is briefly described. The theoretical and methodological contributions of the study are presented before providing an overview of the thesis.

1.2 BACKGROUND OF THE STUDY

Internationally and nationally there has been a move to ensure children have access to quality education. For example, the fourth Sustainable Development Goal (SDG-4) sets a target that by 2030 "all girls and boys [should] complete free, equitable and quality primary and secondary education leading to relevant and effective learning outcomes" (United Nations, 2020, p. 21). In South Africa, the Department of Basic Education's (DBE) Action Plan to 2024 aims to increase the number of learners who meet the minimum competencies in language and mathematics at grades 3, 6 and 9 (Department of Basic Education, 2020a). Both the SDG-4 and DBE Action Plan to 2024 refer to literacy and numeracy as key domains of educational achievement. The current study will only address the domain of literacy.

Universal access to primary education varies across African countries, with about one in five children in Sub-Saharan Africa not attending school as at 2016 (Our World in Data, n.d.). In contrast, South Africa has done well to increase access to education through free and state subsidised basic schooling. A nationally representative survey in 2018 revealed that 99% of all 7 to 13 year olds attend primary schools (Department of Basic Education, 2019a). Nonetheless, there is room for improvement in the quality of the education offered in South Africa. There has been an upward trend in improvement in the proportion of learners who achieve basic literacy skills in South Africa over time, but this improvement is from a very low base (Department of Basic Education, 2020a; van der Berg & Gustafsson, 2019). International studies such as the Progress in International Reading and Literacy Study (PIRLS) revealed that a nationally representative sample of grade 4 children who took the PIRLS Literacy test scored last out of the 50 participating countries (Howie et al., 2017). Children who wrote the test in any of the nine official African languages scored significantly lower than those who wrote the test in Afrikaans and English (the official languages from European descent). Local research reports that many South African children do not meet expected decoding or oral reading fluency competency in an African language (e.g., Ardington, Wills, Pretorius, et al., 2021; Spaull et al., 2020) or English, their additional language (e.g., Cilliers et al., 2022; Pretorius & Spaull, 2016). This situation has been dubbed a reading crisis in the media (e.g., Aitchison, 2018; Rule, 2017). There is no doubt that the disruption to schooling and increase of poverty due to the COVID-19 pandemic has set back much of the progress in the education system (Ardington, Wills, & Kotze, 2021; Shepherd & Mohohlwane, 2021).

Some years before the COVID-19 pandemic, van der Berg et al. (2016) suggested that a number of factors contribute to the current literacy crisis in South Africa. These factors can be categorised into those which pertain to factors external to the learner (environmental factors) and factors internal to the learner (cognitive factors). Van der Berg et al. (2016), addressing the environmental level, mention four binding constraints in education in South Africa, including i) poor functionality of provincial education departments, ii) the influence of teacher unions, iii) underdeveloped pedagogical and content knowledge of teachers, and iv) wasted teaching time. Spaull (2016), also addressing the environmental level, groups the factors affecting literacy as language related (e.g., medium of instruction (MOI) in schools), non-language related (e.g., school functionality) and an interaction between the two (teachers have poor proficiency in the medium of instruction so they use conversational rather than academic language, restricting learners' access to and academic performance in the MOI).

The MOI can affect literacy acquisition through the relative time allocated to each language. Most children in South Africa attend schools where the MOI is an African language in the foundation phase (grade 1 to 3). The African language that is used as MOI is also taken as a subject, and English is taken as a subject, called English as First Additional Language (EFAL), from grades 1 to 3. In grade 4, the MOI typically changes to English, and the African language remains only as an instructed subject. In practice, code-switching and/or translanguaging is common (Wildsmith-Cromarty & Balfour, 2019), thereby making it difficult to quantify the exact time allocated to each language. The focus of the current study is on grades 1 to 3. Based on the curriculum document for these grades and assuming a 42 week school year, children would receive a total of 882 hours of language and literacy instruction in an African language (mostly the child's L1) and 420 hours of English (mostly the child's additional language) language and literacy instruction by the end of grade 3 (Department of Basic Education, 2011b)[1]. These instructional hours stipulated in the curriculum need to result in children who are bilingual and biliterate and able to learn through English instruction from grade 4. Unfortunately, the COVID-19 pandemic related school closures affected the quantity and quality of instruction the current sample of children received, with many children receiving only partial instruction in 2020 and 2021, resulting in flatter trajectories in aspects of reading development (Ardington, Wills, & Kotze, 2021). Other environmental factors which affect learning include quality of instruction, and socio-economic status. The COVID-19 pandemic had observable effects on parental income, and the protective aspects of food provision in schools fell away, increasing child hunger (Shepherd & Mohohlwane, 2022). In addition to these external factors, child internal factors, i.e. individual differences, also affect the rate of literacy development (van der Berg et al., 2016). Internal factors, which are the focus of the present study, include phonological processing skills and vocabulary knowledge. The next section briefly defines these key constructs.

1.3 KEY CONSTRUCTS IN THE STUDY

This study focuses on the longitudinal development of phonological processing and its relation to reading and spelling for two groups of emergent bilinguals. In this study, I use the term *emergent bilingual* (O. García, 2009) rather than the terms English (additional) language learner to refer to children who are learning more than one language, in this case isiXhosa and English or isiZulu and English. The term *emergent bilingual* better demonstrates that children are on a continuum of being able to use their different languages, and positions them in terms of their language strengths, rather than focussing on their English abilities (O. García, 2009). The emergent bilinguals in this study are sequential bilinguals. That is, they are dominant in their L1 and are beginning to learn English just before or during first grade, when they are approximately 5 to 7 years of age.

[1] Time allocation is 10 hours for languages in Grades 1 and 2, with a split 7 or 8 hours for Home Language and 2 or 3 hours for EFAL. In Grade 3, 11 hours are allocated to languages split into 7 or 8 hours for Home Language and 3 or 4 hours for EFAL (Department of Basic Education, 2011b).

Other key constructs in this study include phonological processing (independent variables), vocabulary (control variable), and literacy (dependent variables). Phonological processing includes three skills (PA, PWM, and RAN) which are used in processing and storing sound information for the purposes of reading and writing (Wagner & Torgesen, 1987). PA is the ability to notice and manipulate the sounds of one's language (Anthony & Francis, 2005). PA is particularly important at the early stages of literacy acquisition because it allows beginning readers to associate sound units within words (such as phonemes or syllables) with graphemes (such as letters, and groups of letters) (Ziegler & Goswami, 2005). In other words, readers need PA skills to grasp the alphabetic principle (i.e., that letters on a page correspond to sounds in a language) that is needed for reading and spelling in alphabetic languages. PA and literacy are reciprocally related. A certain level of PA is needed for literacy to be acquired, and then, as children become more skilled in reading and writing, their PA skills improve over time (Melby-Lervåg et al., 2012). PWM is the ability to temporarily store sound-based representations in working memory (Wagner & Torgesen, 1987) and is used during cognitive tasks that involve processing sound-based information (Anthony et al., 2007). PWM is used by readers to associate phoneme-grapheme correspondences in working memory which are later stored in long term memory. PWM is also important for vocabulary learning and reading comprehension (Baddeley, 2012). RAN is the ability to name, as quickly as possible, visually presented familiar objects or symbols (Norton & Wolf, 2012). These symbols can be alphanumeric (letters and digits) and non-alphanumeric (objects and colours). RAN has been conceptualised as an index of automaticity in lower level word reading processes (Norton & Wolf 2012) and also as an index of fluent reading processes (Lervåg & Hulme, 2009). PWM and RAN improve with age and scholars agree that the development of these skills depend, to some extent, on maturation (Landerl et al., 2022; Shuai Zhang & Joshi, 2020). It is, however, less clear whether these skills are influenced by instruction or affected by the acquisition of literacy (Peterson et al., 2018; Wolf et al., 2009; Shuai Zhang & Joshi, 2020; Zugarramurdi et al., 2022), and therefore whether these skills should be the focus of literacy instruction is still debated (Shanahan, 2020).

Vocabulary refers to the amount and quality of word knowledge a speaker has (Schmitt, 2014). Word knowledge includes knowledge of the form (how the word sounds and is written), meaning (what the word means), and use (in what contexts the word is used) of words and multiword units (Nation, 2013). Vocabulary is part of oral language ability and contributes to oral language comprehension and reading comprehension (Nation, 2013). Vocabulary and literacy are also bidirectionally related (Hedgcock & Ferris, 2018): vocabulary knowledge enhances reading comprehension, and reading contributes to improvements in both vocabulary size and vocabulary depth. Vocabulary knowledge is tied to the amount and quality of language input (Jordaan et al., 2021; Monsrud et al., 2019). Thus, sequential bilingual children often have smaller vocabularies than monolinguals in each language (Oller et al., 2007), which constrains their reading comprehension, all else being equal (Geva et al., 2019).

As mentioned previously, literacy, in this study, refers to the component skills that contribute to being able to read and write. The component skills addressed in this study are letter-sound reading, word reading, text reading, reading comprehension, emergent writing, and spelling. Knowing letter-sound correspondences (also called phonics) is a precursor to being able to read words and texts, as words need to be parsed at the letter level, for the most part during early reading development. Word reading refers to the ability to decode words whether by breaking the word down into its component letters or syllables (called phonological recoding, Share, 1995), or by sight (as a whole word) to retrieve the phonological and semantic information it represents. Reading comprehension is the ability to understand what one has read (Kim, 2020b).

Bi- or multilingual readers may be able to rely on their cognitive-linguistic and literacy skills in one language to support the other language in a process called transfer. Cummins' (1979) Linguistic Interdependence Hypothesis explains that speakers can use underlying proficiencies (e.g., alphabetic knowledge, PA and working memory) in helping them become proficient in another language. The ability to transfer common proficiencies from one language to another is affected by the similarity in writing system, language structure and instruction (Geva et al., 2019; Melby-Lervåg & Lervåg, 2011). Nevertheless, there is increasing evidence that multilingual speakers can and do draw on the resources they have in the languages they know (Cummins, 2017). Meta-analytic research has shown that transfer is more likely across constrained skills (e.g., PA, decoding) than unconstrained skills (e.g., vocabulary, reading comprehension) (Melby-Lervåg & Lervåg, 2011).

1.4 RESEARCH PROBLEM

The importance of literacy for education has resulted in a growing body of research on cognitive-linguistic skills and literacy skills in the African context, although literacy skill, rather than cognitive-linguistics skills, has received the most focus for reasons that will be explained. For example, the South African Department of Basic Education has lead two large scale Early Grade Reading Studies which have contributed to our understanding of how literacy (predominantly reading) develops over time for early readers in isiZulu, Setswana and Siswati, and how language of instruction affects literacy acquisition (Kotze et al., 2019; Taylor et al., 2017). Researchers have also collated data from various projects to identify early grade reading benchmarks in the various languages of South Africa: Afrikaans (Ardington et al., 2022), Nguni languages (Ardington et al., 2020b), Sesotho and Setswana (Mohohlwane et al., 2022), and English FAL (Wills, Ardington, Pretorius, et al., 2022). Reading benchmarks for Xitsonga and Tshivenda are being developed.

In contrast, the in-depth examination of phonological processing skills in beginner readers has been limited by the availability of assessments, as well as time constraints in research projects. In terms of availability, the cost of standardised English assessments for phonological processing makes their widespread use in South Africa prohibitive. For the African languages, no standardised tests exist (van Dulm & Southwood, 2014), so tests are often made by researchers working in each African language (Daries, 2021; de Sousa et al., 2010; Wilsenach, 2016) and not always in parallel with English assessments (Makaure, 2021, is an exception). The consequence of not using or creating parallel tests to measure L1 and English is that the comparability of scores across languages is more limited[2]. In terms of time constraints, phonological processing assessments take a fair amount of time to administer and do not fit into the time constrained environments of large-scale testing. Phonological processing tasks have been included in some large-scale assessments, but rarely are all three components (PA, PWM, RAN) assessed at once. For example, as part of the evaluation of the Second Early Grade Reading Study (EGRS 2), initial sound isolation (a PA task), and word and nonword repetition (PWM tasks) were included in the grade 1 baseline test, but dropped for the third wave of data collection (grade 2), where RAN object and letter naming were included instead (Department of Basic Education & University of the Witwatersrand, 2020).

The number of smaller research projects exploring the relationship between phonological processing and literacy skills in African languages has increased in recent years in South Africa and Sub-Saharan Africa. Smaller studies which have examined at least one phonological processing component have been conducted with children who speak: Herero (Veii & Everat, 2005), isiXhosa (Clark et al., 2019; Diemer et al., 2015; Schaefer et al., 2020), isiZulu (de Sousa et al., 2010), Northern Sotho (Makaure, 2021; Wilsenach, 2013, 2016, 2019; Wilsenach & Makaure, 2018), Oshikwanyama (Nghikembua, 2020), Setswana (Lekgoko & Winskel, 2008; Malda et al., 2014; Probert, 2019) and Xitsonga (Khosa, 2021). Phonological processing of English second language speakers in the South African context has also been examined (e.g. Le Roux et al., 2017). Most of these studies are cross-sectional, examine predominantly PA and not the other phonological processing skills, focus on word reading as the literacy outcome and less on reading comprehension, and do not always measure the same constructs in both languages. These limitations make it

[2] The language structure of isiXhosa, isiZulu and English are addressed in section 3.6.

difficult to determine the causal relationships among all three phonological processing skills and literacy within and across the languages of bilingual African Language-English emergent bilingual readers. While existing theories suggest that cross-linguistic transfer of phonological processing skills are possible, and should aid the development of biliteracy, not much is known about how and when phonological processing skills transfer between African languages and English, where the phonological structures and orthographies of the languages are diverse. Additionally, few studies compare closely related African languages to one another in the same study, making it difficult to determine whether phonological processing develops similarly in closely related African languages. A thorough understanding of cross-language similarities and differences in the development of cognitive-linguistic and literacy skills is required if teaching strategies are to be optimised in different languages (Goswami, 2005), and if resources are to be efficiently used. The goal of the present study is to address some of the knowledge gaps identified above, by investigating the longitudinal relationship between phonological processing and literacy skills in isiXhosa-English and isiZulu-English bilingual children using parallel assessments in L1 (isiXhosa and isiZulu) and English.

1.5 AIMS AND SCOPE OF THE THESIS

In the present study, I aim to determine the within-language and across-language longitudinal development of, and association between, the phonological processing skills (PA, PWM and RAN) and literacy skills (letter-sound knowledge, reading fluency, reading comprehension, spelling) of emergent bilingual speakers of two closely related African languages (isiXhosa and isiZulu), and English from grades 1 to 3. This broad aim has been split into various sub-aims. The sub-aims of the research are:

i. To develop parallel phonological processing and literacy assessments for isiXhosa and isiZulu;
ii. To determine the factor structure of bilingual PA, PWM and RAN in grade 1 and the start of grade 3;
iii. To determine the concurrent (cross-sectional) within and across-language associations between bilingual phonological processing and bilingual literacy skills in grade 1 and the start of grade 3;
iv. To determine the longitudinal within and across-language associations between bilingual phonological processing and bilingual literacy from grade 1 to the start of grade 3, from grade 1 to the end of grade 3, and from the start of grade 3 to the end of grade 3;
v. To present the longitudinal developmental trajectory of phonological processing and literacy skills in the isiXhosa and isiZulu groups;

vi. To determine whether the associations between and development of phonological processing and literacy skills are the same for the isiXhosa and isiZulu groups.

1.6 RESEARCH QUESTIONS AND HYPOTHESES

I address one main research question in this study:

What are the within-language and across-language longitudinal relationships between phonological processing skills (PA, RAN, PWM) and literacy skills (letter knowledge, reading fluency, reading comprehension, and spelling) in isiXhosa-English and isiZulu-English emergent bilingual children from grade 1 to grade 3?

I pose the following sub-questions in order to answer the main research question:

1. To what extent do language specific vs language general models of bilingual PA, RAN and PWM fit the data in grade 1 and grade 3 for each language group?
2. What are the concurrent (cross-sectional) associations between bilingual phonological processing skills (PA, RAN, PWM) and bilingual literacy skills (reading fluency, spelling) for each language group in grade 1 and the start of grade 3?
3. What are the longitudinal associations between bilingual phonological processing skills (PA, RAN, PWM) measured in grade 1 and bilingual literacy skills (reading fluency, spelling, reading comprehension) measured in grade 3 for each language group?
4. To what extent do scores on phonological processing and literacy tasks develop over time for each language group?
5. What are the concurrent and longitudinal associations between vocabulary and literacy skills after controlling for phonological processing skills?
6. What do the concurrent and longitudinal associations reveal about why RAN may be related to literacy?

In general, I expect that all three phonological processing skills would be longitudinally related to literacy outcomes. Based on literature reviewed in chapter 2, I expect PA to play a larger role in spelling, for RAN to play a larger role in reading fluency, for PWM to play a larger role in letter recognition and reading comprehension, and for vocabulary (a control variable) to influence reading comprehension. For the cross-sectional analyses (sub-question 2), I expect that PA and RAN in each language would be related to reading and spelling in each language. I expect that L1 phonological processing skills would exert more influence on English skills than vice versa because participants are sequential bilinguals who theoretically are more proficient in their L1. I did not expect to find a large role of PWM concurrently given mixed findings for emergent bilinguals in South Africa (Makaure, 2021). With regards to the first sub-question, I expect phonological processing skills to be language specific (e.g., PA should be conceptualised (and then measured) in L1 and English, etc.) because the participants are emergent bilinguals who I estimate have not had much exposure to English before starting school. Finally, with regards to sub-question 4, I expect that there will be improvement in the scores on the various tasks from grade 1 to grade 3, but I have no expected effect size[3]. I expected vocabulary to be positively related to reading skills. Sub-question 6 was exploratory and I did not have a specific expectation from the outset about what the data would suggest about why RAN is related to reading.

1.7 RESEARCH METHOD

I designed this study as a quantitative quasi-experimental longitudinal study which follows the phonological processing and literacy development of the same sample of isiXhosa-English and isiZulu-English emergent bilingual learners from grade 1 to grade 3. The study took place from 2019 to 2021 and was, thus, affected by COVID-19 related school closures, and rotational timetabling[4].

A group of research assistants and I collected quantitative child data at three time points. At t1 vocabulary was measured in mid-grade 1, and phonological processing and literacy were measured towards the end of grade 1. At t2, at the start of grade 3, phonological processing and literacy were measured. At t3, towards the end of grade 3, literacy was measured. Home background factors that impact learning and literacy development were recorded through a parent administered telephonic questionnaire between t2 and t3. Standardised English tests were used including the second edition of the Comprehensive Test of Phonological Processing (CTOPP; Wagner et al., 2013), the fourth edition of the Peabody Picture Vocabulary Test (PPVT; Dunn & Dunn, 2007), and the Diagnostic Test of Word Reading Processes (DTWRP; Forum for Research in Literacy and Language Institute of Education, 2012). I translated and adapted the PPVT into isiXhosa and isiZulu, and I created comparable

[3] I conceptualised the study and wrote the core of the introduction before the longitudinal trajectories of Nguni and Sotho (Ardington et al., 2020b; Wills, Ardington, & Sebaeng, 2022), and EFAL (Wills, Ardington, Pretorius, et al., 2022) reading fluency were released, and the developmental trajectories of phonological processing tasks in Northern Sotho and English were addressed by Makaure (2021). These studies are useful to understand longitudinal developmental trajectories in reading fluency and phonological processing skills in the South African context.

[4] More details are provided in Chapter 3 in section 3.3.3.

phonological processing and word reading tests for isiXhosa and isiZulu, where I ensured that the isiXhosa and isiZulu tests were parallel. I used literacy tasks from large scale assessments in South Africa to measure some of the literacy skills (i.e., oral reading fluency, reading comprehension) in English, isiXhosa, and isiZulu. The benefits of using predominantly standardised or already piloted and used assessments in the South African context are that the tests already have data on their validity and reliability, and there is data to compare my results to.

As is often the case when conducting research with school children, true random assignment to groups was not possible. In this study, I therefore compared the phonological processing and literacy development of pre-existing groups of children in schools which use isiXhosa and isiZulu as the MOI in the foundation phase. Thus, L1/MOI were the manipulated variables in this study. The participants were first assessed midway through their first grade (on vocabulary), and the intention was to assess the children at the end of the first, second and third grade (in 2019, 2020 and 2021) on parallel phonological processing and literacy tasks, so that there was a similar length of time between each testing point. However, due to the impact of the COVID-19 pandemic in 2020, the participants were assessed during the second and third term of grade 1 (in 2019 prior to the COVID-19 pandemic), and at the start and end of grade 3 (in 2021, during the COVID-19 pandemic).

I recorded the paper and pencil data in spreadsheets and analysed the data using R (The R Foundation for Statistical Computing, 2021). As part of the quantitative analysis, I examined the psychometric properties of the research instruments designed for the study to determine their validity and reliability in the research context, which is reported in chapter 3. I examined the bilingual dimensionality (i.e., where constructs were language specific or language general) of the phonological processing skills (chapter 4 and 5). Principal components scores were used to derive one score out of tasks that measured the same construct (e.g., the word and text reading fluency scores were transformed into one construct via principal components analysis). I analysed the data from each time point using structural equation modelling with observed variables, also called path modelling, to determine the concurrent (cross-sectional) and longitudinal relationships between phonological processing skills and literacy skills, when controlling for vocabulary. The cross-sectional analyses are presented in chapters 4 and 5, and the longitudinal analysis is presented in chapter 6. Chapter 6 also presents models of the longitudinal development of scores on the phonological processing and literacy tasks.

1.8 LIMITATIONS

As with any research study, it was not possible to document all aspects relevant to developmental trajectories of phonological processing and literacy. It is, thus, necessary to clearly define the scope, and, therefore, the limitations to the research study. In the present study, I focus on cognitive-linguistic variables and conceptualise literacy from a cognitive-linguistic perspective. Participants underwent extensive individual assessment which took on average one hour per testing point with multiple testing points per year in this three-year longitudinal study. Home background information about language and literacy experience was also collected from consenting parents via telephonic structured interviews. Despite this extensive assessment, some aspects which affect literacy development were not addressed in the present study.

I explored only one range of cognitive-linguistic skills, namely phonological processing skills, which are critical for *early literacy acquisition*. Vocabulary was also assessed at the start of the study as a control variable because of its particular influence on both phonological processing and reading development, and as a way to determine participants' initial levels of bilingualism in the languages of interest. The time constraints did not allow the assessment of morphological processing, orthographic processing, and syntactic processing, which also contribute to literacy development. Interested readers are directed to (Rees, n.d., 2016) for research on morphological processing, and Daries (2021) and Cox (2022) for research on orthographic processing in isiXhosa.

I have also limited the study to isiXhosa-English and isiZulu-English participants. These African languages are spoken by the largest number of people in South Africa. Literacy in these two languages has also been most researched in the South African context. Thus, although standardised assessments are not available in these African languages, there is research (specifically on literacy) I can compare my results to (e.g., Ardington, Wills, Pretorius, et al., 2021). I did not assess children across many different schools since the aim of the study is to document phonological processing and literacy development and the relationship between these variables, and not (primarily) to influence instruction or account for the variance explained by the nesting of children in schools. I have also not observed the teaching methods used by the teachers or interviewed teachers about their teaching approaches and methods. I have relied on descriptions of the teaching curriculum in departmental documents and have included notes on the school context that I observed while completing the research in each school.

I acknowledge the importance of children's socio-cultural context on literacy acquisition, so I have included a structured questionnaire for parents on home background factors to capture some of this information. Some of this information is presented in chapter 3. Nevertheless, an in-depth examination of the influence of socio-cultural factors on literacy development is outside the scope of this study.

1.9 CONTRIBUTION OF THE STUDY

This cross-linguistic longitudinal study which documents the development of phonological processing and literacy skills in historically under-researched languages, and in a historically under-represented context will contribute to the confirmation of universals, and the identification of particulars in literacy acquisition. Through this research I examine phonological processing and literacy development and apply language transfer theories to the South African context, allowing an evaluation of the suitability of these theories which are based on predominantly European languages. I expect to find a similar phonological processing and literacy developmental trajectory as described for other languages, emphasising the essential role of phonological processing for literacy acquisition in alphabetic writing systems. I expect to find evidence of cross-linguistic transfer from L1 to English, and from English to L1. Identifying whether these relations are positive or negative adds to the growing understanding of the educational contexts that lead to language transfer. Furthermore, I expect to demonstrate that findings from closely related languages can be generalised to one another (i.e., research on isiXhosa can be applied to isiZulu literacy development). This finding should increase efficiency in teacher and materials development as one can rely on a larger body of evidence than only what is available for each particular language.

Methodologically, I will contribute valid and reliable isiXhosa and isiZulu language assessments which, with further refinement, can be used by other stakeholders such as psychologists, speech language therapists and educators. These assessments encourage the accumulation of information on the levels of cognitive-linguistic skills obtained by children in various grades. The detailed description of test development makes it possible for future researchers to create similar parallel assessments for other languages, thereby extending our understanding of typical and atypical development. Once more information is available, the results based on these assessments can be used to identify children at risk for reading failure and provide targeted 'just in time' intervention.

Finally, the basic research (Shanahan, 2020) presented in this study can form the foundation of more applied research in instruction and how African language and English literacy should be taught in the South African context. Determining the best evidence-based approaches to teaching literacy is a research priority of the Department of Basic Education (Department of Basic Education, 2019c). Documenting how phonological processing and literacy skills develop longitudinally within and across the languages of bilingual speakers gives educators insight into what skills are important at different points in the developmental trajectory.

1.10 Overview of the structure of the thesis

In the current chapter I introduced the focus and context of the research study and identified the research gap – that despite evidence that phonological processing skills are important for reading in alphabetic languages, they have been largely underexplored in the African context, especially from a detailed longitudinal perspective. I explained how the present study will address this gap by focussing on isiXhosa-English and isiZulu-English emergent bilingual children from grades 1 to 3. I explained how the study is limited to exploring literacy from a cognitive perspective. Thus, instructional methods and socio-cultural factors were not (extensively) explored. I also introduced the longitudinal research method where both cross-sectional and longitudinal analyses will be completed. I finally indicated that the contribution of the study is threefold: (1) phonological processing, literacy and language transfer theories are applied to a historically under researched context, (2) psychometrically sound parallel language assessments were created, and (3) the study forms the foundation for future research in effective instructional approaches in these languages. In chapter 2 I review and evaluate the literature relevant to the development of cognitive-linguistic skills and literacy, and I address the theories used in this study. Specifically, in chapter 2 I define the key terms used in this study and describe current knowledge about how cognitive-linguistic skills (phonological processing and vocabulary) contribute to the development of literacy (word reading, reading comprehension and spelling). In chapter 3, I document the decisions I made regarding the research design, research method, research instruments and data analysis. I also describe the research context and the ethical considerations related to the study. A brief review of the language structure of isiXhosa and isiZulu is presented as the research instruments were designed with the language characteristics in mind.

In chapters 4, 5, and 6, I present the results of the study. In chapter 4, I present the cross-sectional results from grade 1, and, in chapter 5, I present the cross-sectional results from the start of grade 3. In chapter 6, I first present the cross-sectional results from the end of grade 3, then present the analysis of the longitudinal development of phonological processing and literacy, as well as the longitudinal analysis of how grade 1 phonological processing skills are related to literacy skills at the start and end of grade 3, and how start of grade 3 phonological processing skills are related to the end of grade 3 literacy outcomes. Finally, in chapter 7, I discuss the main conclusions from the research study thematically and end with suggestions for avenues for further research.

2 Chapter 2. The development of literacy and cognitive-linguistic skills within and between languages

2.1 INTRODUCTION

In this chapter, the key constructs of this study are defined. The main constructs in this study are literacy, vocabulary, and phonological processing (which includes PA, RAN, and PWM). Theoretical frameworks that conceptualise how these constructs are related are presented and these frameworks inform the description of how the constructs develop over time and relate to one another within and between languages.

Specifically, this chapter is organised into six main sections. Sections 2.2 and 2.3 address literacy and vocabulary development, respectively. Theories that seek to explain reading development and cross-language transfer are also addressed in section 2.2. Section 2.4 defines the constructs of PA, RAN and PWM and addresses how these constructs develop over time, and are related to literacy. Additional theoretical considerations related to RAN are presented in section 2.5. Section 2.6 provides an overview of cross-language transfer of PA, RAN and PWM and examines how these skills are transferred across the languages of a bilingual reader. Research from South Africa is referred to throughout the review and is summarised in section 2.7. Most of the literature I refer to has been published in the last decade and a half, but I refer to older studies where these were seminal, or to demonstrate the development of the field. Especially in South Africa, a lot of literacy research has been conducted in the last two years. To present an up-to-date literature review, I have chosen to include 'grey' literature including preprints, working papers and reports when peer-reviewed publications are not yet available.

2.2 LITERACY DEVELOPMENT

As explained in chapter 1, literacy in this study is defined as the ability to read and write. While learning how to speak or sign will take place automatically with sufficient input, reading is a skill which needs to be learned (Seidenberg, 2013), and which is supported by explicit instruction (Ehri, 2020; Odo, 2021; Share, 1995). Reading development involves three types of skills: code related skills, oral language skills, and domain-general cognitive skills (Bhalloo & Molnar, 2021). Code related skills are related to the orthography being read and are least likely to develop spontaneously. Oral language skills, which include vocabulary knowledge, are important to access the meaning of what is being read. Finally, reading also relies on domain-general cognitive skills such as visual and auditory processing skills, working memory, and inferencing ability. In section 2.2, I first address L1 literacy development and provide an overview of theories that seek to explain (L1) reading development. I then address literacy development in an additional language and provide an overview of theories that seek to explain cross-language transfer.

2.2.1 First language literacy development

Reading skill develops over time. Initially, reading begins with the novice reader making two key discoveries: (1) that written language represents spoken language, and (2) that spoken language represents both sound and meaning (Goswami, 2005; Perfetti & Verhoeven, 2017). Reading skill then develops first from effortful conscious attention on letter-sound correspondences, decoding, and word recognition. Then, with sufficient practice, decoding and word recognition become automatic, leading to fluent reading, and reading comprehension. Because the nature of reading changes with experience and familiarity with reading, the underlying skills implicated in reading differ with reading experience.

The sub-sections below address the two key principles above, as well as letter knowledge, decoding and word recognition, reading fluency, reading comprehension and spelling.

2.2.1.1 Principle 1: Written language represents spoken language

Languages can be represented by a variety of writing systems, which foreground different sound or meaning units. For example, alphabets (such as the Roman alphabet) use letters to represent phonemes (smallest sound units) in languages such as English, isiXhosa, or Portuguese. On the other hand, morphosyllabaries, such as that used to represent Chinese, represent both morphological and syllabic information. This study focusses on alphabetic reading: English, isiXhosa, and isiZulu are written using the Roman alphabet. The realization that phonemes can be represented by letters is termed the alphabetic principle (Byrne & Fielding-Barnsley, 1989). This realization occurs at the start of formal literacy instruction when letter knowledge is related to phonemic awareness (Byrne & Fielding-Barnsley, 1989).

Not all alphabets are the same, however. The consistency of the relation between spoken and written language varies, i.e., the consistency of the spelling-sound or sound-spelling relationship varies across alphabets. This variation in consistency is termed orthographic depth (L. Katz & Frost, 1992). Alphabets which, for the most part, always use the same letter to represent the same sound are called consistent, shallow, or transparent orthographies. For example, Finnish uses 24 letters to represent the same 24 sounds. isiXhosa and isiZulu also use transparent orthographies where sounds are represented consistently by the same letters, e.g., *a* is always pronounced /a/. On the other hand, some alphabetic orthographies, such as that for English, vary considerably in how sounds are represented by letters, and how letters represent sounds. For example, the same letter *a* is used to represent various sounds in the following English words: *cat, car, cape, caught*. These orthographies which have less consistent letter-sound relations are called inconsistent, deep, or opaque orthographies.

Orthographies which are less consistent take longer to learn. For example, Seymour et al. (2003) examined the letter knowledge, real word and nonword reading speed of children reading in alphabets which varied in orthographic consistency. English was included as the most inconsistent orthography, Finnish was the most consistent, and Portuguese was included as an intermediate consistent orthography (among others). The researchers found that letter knowledge, word and nonword reading speed and accuracy was (s)lowest for the inconsistent orthographies. The study by Seymour et al. (2003) was conducted with monolingual participants. Bilingual readers have the challenge of learning how each language is represented in writing. Both the letter-sound and sound-letter mappings, and their consistency may vary in each language. For example, isiXhosa-English readers must develop language specific orthographic representations for each language: *a* is always pronounced /a/ in isiXhosa, but in several ways in English (see example above: *cat, car, cape, caught*). Likewise, the bilingual reader must learn that the same sound can be represented differently in each language: /a/ is represented by *a* (e.g., *amasi*) in isiXhosa but by *u* (e.g., *up*) in English.

2.2.1.2 Principle 2: Spoken language represents both sound and meaning

With regards to the second point (that spoken language represents both sound and meaning), readers need to develop metalinguistic awareness (Perfetti & Verhoeven, 2017). Metalinguistic awareness is "the ability to think about and reflect upon the nature and functions of language" (Pratt & Grieve, 1984, p. 2). One metalinguistic skill used for reading in all languages is PA (Perfetti & Verhoeven, 2017), which is the awareness of and ability to manipulate the sounds of one's language (Adams, 1990; Anthony et al., 2003). This skill helps readers parse the speech stream allowing them to establish phonology-orthography correspondences. PA is addressed in detail in section 2.4.1. Another metalinguistic skill important for reading is morphological awareness. This is the awareness of and ability to manipulate the morphological units and use the word formation rules of a language (Carlisle et al., 2010; Kuo & Anderson, 2006). Morphological awareness is used in decoding as well as reading comprehension. Syntactic awareness refers to the awareness of and ability to manipulate the grammatical structure of language (Cain, 2007). It is implicated in word reading and reading comprehension. Morphological and syntactic awareness are mentioned here briefly but are not the focus of the current study.

Metalinguistic awareness, specifically phonological and morphological awareness, helps readers learn and establish orthography-phonology and orthography-morphology correspondences particular to the orthography and language being read. Metalinguistic awareness develops naturally through maturation, but is also developed through formal literacy instruction (Anthony &

Francis, 2005; Carlisle et al., 2010). This thesis focuses on PA and other phonological processing skills (including RAN and PWM) and how they relate to reading and spelling development. Phonological processing skills are addressed in detail in section 2.4.

2.2.1.3 Letter name and letter-sound (alphabet) knowledge

After children have realized that language includes both sound and meaning, and both sound and meaning can be represented in print, the next step is to learn the symbols that represent speech in writing. In alphabets, these symbols are letters. Beginner readers need to learn how letters correspond to sounds in the alphabet they are learning to read (Treiman et al., 1998). English uses 26 letters from the Latin alphabet. isiXhosa and isiZulu use these same 26 letters. However, all three languages have more than 26 phonemes. To represent the various sounds of these languages, letters are grouped together to represent new sounds. For example, in English, /tʃ/ is represented as *ch* (e.g., *chip*) at the start of words and *tch* at the end of words (e.g., *catch*). In isiXhosa and isiZulu, /tʃ/ is represented by *tsh* consistently (e.g., *titshala* – *teacher*). When two letters are used to represent one sound (e.g., *ch*) these letter groups are called digraphs. Three letters in a group to represent one sound is called a trigraph (e.g., *tsh* or *tch*). In this study, I refer to digraphs and trigraphs as letter groups (Treiman, 2018) for simplicity.

Alphabetic knowledge includes both knowledge of the names of the letters (the name of *a* is *ay*) as well as knowledge of the sounds that letters correspond to (*a* represents the sound *ah* as in *apple*[5]). Education systems vary in whether letter names and/or sounds are taught first, or simultaneously. For example, children are taught letter names first in the United States of America, but letter sounds first in England (Anthony et al., 2021)[6]. Children use their knowledge of letter names to develop letter-sound knowledge and learn letters which have the phonetic component in their name (e.g., *f* – *ef*) before letters which have no such clue (e.g., *h* – *aitch*) (Anthony et al., 2021; Evans et al., 2006). The frequency with which letters appear in print also affects letter-sound learning – more frequent letters are learned before less frequent letters (Evans et al., 2006; Kim, Petscher, et al., 2021), and more common pronunciations of letters

[5] Of course, accent plays a role in letter-sound correspondences. Many English additional language speakers in South Africa will say [eɪpəl], not [æpəl] such that the first syllable of *apple* sounds the same as the letter name for *A*.

[6] I could not find explicit mention of how the alphabet is taught in South African classrooms. On page 33 of the National Framework for the Teaching of Reading in African Languages in the Foundation Phase, it is implied that letter sounds should be taught (Department of Basic Education, 2020b). Since this framework argues for better teaching, it may be the case that other approaches are used such as chanting the alphabet song (e.g., O' Carroll, 2011).

and letter groups are learned before less common pronunciations (Treiman & Kessler, 2021).

In countries where languages with open syllable structures are spoken, such as South Africa and Brazil, alphabetic knowledge of letters is typically taught through syllables. For example, the letter *m* is taught not by using the letter by itself, but by joining it to a vowel e.g., *ma, me, mi, mo, mu* or *ba, be, bi, bo, bu* in isiXhosa (South Africa: Pretorius, 2015) and Portuguese (Brazil: Sargiani et al., 2021). There is still a debate in South Africa about whether alphabetic knowledge in African languages should be taught using syllables or letters (Department of Basic Education, 2020b). Preliminary research, however, indicates that letter instruction is more effective than syllable instruction in teaching letter knowledge in Brazilian Portuguese (Sargiani et al., 2021), and research from large scale interventions in South Africa show that children who receive explicit letter based phonics instructions (among other intervention provisions such as textbooks) can more automatically recognize letters and letter groups compared to a group in 'business as usual' instruction where these letter-sound correspondences are not necessarily systematically emphasized (Ardington & Meiring, 2020). The National Framework for the Teaching of Reading in African Languages in the Foundation Phase, suggest that letter sounds at the phoneme level should be taught, in addition to the use of syllable level instruction (Department of Basic Education, 2020b).

Alphabet knowledge is an important precursor for reading in languages that use an alphabet (Landerl et al., 2022). Alphabet knowledge is a constrained skill, i.e., there is a finite number of letter names and letter sounds to learn (Anthony et al., 2021). Some children may start school with less familiarity with letters than others due to socio-economic background and educational experience. For example, O'Carroll (2011) reports that in South Africa, teachers in early learning centres in low socio-economic areas teach the alphabet through use of the alphabet song and rote learning, where children are often not provided their own opportunity to make letter-sound correspondences other than through rote repetition. The result is that many children begin grade 1 with no or little alphabet knowledge. O'Carrol found that almost half of the children at the start of grade 1 in her study (N = 194) could not produce any of the letters presented. The letters included *a, b, c, e, f, m, o, r, s, t*. Even though alphabet knowledge may vary for different children, with sufficient instruction and practice, typically developing children should be able to master the limited number of letter-sound correspondences fairly easily (Anthony et al., 2021). This alphabet knowledge is used by children in word decoding and word recognition, which is discussed in the following sub-section.

In large scale studies in South Africa, alphabet knowledge is assessed using the one-minute timed letter-sound recognition fluency (LRF) task in the Early Grade Reading Assessment (EGRA) (Dubeck & Gove, 2015). The task includes an array of 10 columns by 11 rows of letters (e.g., *a, g, s*) and letter groups (e.g., *sh, hl, tsh*). The number of items read in one minute and any errors are recorded. A stop criterion is applied if a participant cannot read the first five letters. The final score is the number of letters read correctly in one minute. Many children score zero on this task at the beginning and end of grade 1 indicating they do not have well developed alphabet knowledge (Wills, Ardington, & Sebaeng, 2022). When the letter-recognition task is split into a simple recognition task (of single letters) and a complex recognition task (of digraphs and other letter groups), scores drop for multi-letter recognition, indicating that simple letters are more automatically recognized than multi-letter units. For example, at the end of grade 1, an isiXhosa sample had mean scores of 24.3 single letters correct and 6.2 multi-lettered units correct in one minute (Ardington & Meiring, 2020). These low scores for multi-letter unit reading are concerning since, for example, even high frequency words in isiXhosa contain digraphs and trigraphs (J. Katz & Rees, 2022). Thus, even in consistently written languages, children require explicit instruction in how the sounds of their language correspond to print.

Alphabetic knowledge assessed before formal schooling has a weak to moderate correlation (r = .40) to reading comprehension measured, on average, three years later, as reported in a meta-analysis of 26 studies by Hjetland et al. (2020). Recently, in South Africa, the Department of Basic Education has used this stability in the relationship between early letter knowledge and later reading comprehension by determining benchmark levels of letter-sound recognition fluency that should be achieved by the end of first grade. The Department of Basic Education advises that children should be able to correctly sound out 40 letter sounds per minute in the language of instruction by the end of first grade (Ardington et al., 2022; Ardington, Wills, Pretorius, et al., 2021; Mohohlwane et al., 2022; Wills, Ardington, Pretorius, et al., 2022).

2.2.1.4 Decoding and word recognition

Another foundational skill that contributes to successful reading is word reading or word decoding ability. Decoding (also called phonological recoding) refers to the process of associating written words with their spoken equivalents by analysing the letter-sound correspondences in the word (Share, 1995). Koda (2007, p. 4) refers to decoding as "extracting linguistic information directly from print". Decoding relies on the development of letter-sound correspondence knowledge and PA. Depending on the familiarity with reading, this process of decoding can be slow and effortful. With more reading practice, exposure to words, and use of morphemic knowledge[7], readers build up an orthographic lexicon leading to the automatic recognition of familiar words, a process called word recognition (Ehri, 2020; Share, 1995). Decoding and word recognition are essential lexical-level skills for the development of text reading fluency and reading comprehension (Kim, Quinn, et al., 2021). Decoding also has a very strong correlation (r = .74) with reading comprehension (J. R. García & Cain, 2014), and as such is a critical foundational skill of reading. Theoretical explanations of how word recognition develops is addressed in section 2.2.2.

Word reading (also called isolated word reading) ability is measured by asking participants to read word lists out loud. Words are presented either in a list or a grid. Usually, a stop criterion rule is applied so participants are asked to stop reading after a certain number of consecutive errors. Word reading can be measured using an accuracy (untimed) or a fluency (timed) score. In untimed tasks, such as those in the Diagnostic Test of Word Reading Processes (DTWRP) (Forum for Research in Literacy and Language Institute of Education, 2012), the final score is the number of words read correctly before the stop criterion rule was applied. In timed tasks, such as those used in the EGRA, participants have a specific amount of time, such as one minute, to read as many words as they can. The final score is the number of words read correctly in a minute. Because reading takes longer to be automatic and accurate in inconsistent orthographies, word reading accuracy tests are often used (Moll et al., 2014). Fluency measures are usually used for readers of consistent orthographies because they reach high levels of accuracy early on in formal literacy instruction (Seymour et al., 2003). Educational context is important in determining the rate at which word reading becomes accurate. For example, in South Africa, where the instruction of skills underlying reading is not always explicit, readers are still very inaccurate and dysfluent even though they are learning to read in a consistent orthography (Menendez & Ardington, 2018).

2.2.1.5 Text Reading fluency

Oral reading fluency refers to the ability to read a text out loud accurately and with appropriate speed and prosody (intonation) (Fuchs et al., 2001; Hasbrouck & Tindal, 2006). Other definitions of text reading fluency emphasise that word recognition during text reading should be accurate and automatic so that reading comprehension is not hindered (Pikulski & Chard, 2005). Text reading fluency relies on automatic word recognition and decoding, as well as integration of syntactic and semantic information based on oral language ability, and is affected by domain-general factors

[7] More experienced readers develop morphology-orthography correspondences in addition to phonology-orthography correspondences. Knowing how frequent morphemes map to orthography assists readers in recognising words.

such as executive function (Kim, 2020b). Fluent text reading supports reading comprehension directly, but also because it mediates the relationship between word recognition and reading comprehension, and between oral language ability and reading comprehension (Kim, 2020b). Thus, text reading fluency could be considered a 'bridge' to reading comprehension (Pikulski & Chard, 2005), and is a good measure of overall reading competence (Fuchs et al., 2001).

The automaticity theory by LaBerge and Samuels (1974) explains why text reading fluency can be considered to index overall reading competence. This theory refers to the fact that human brains have limited processing capacity because working memory is limited. Executing any complex multi-component skill, such as reading text fluently, relies on available working memory capacity. When the sub-skills of text reading, such as word recognition, are not automatic, they require conscious attention and working memory resources. Because working memory capacity is already limited, this conscious attention to lower level skills means there is not capacity for higher order skills, such as reading comprehension. When the lower level skills of reading, such as word recognition, are automated, this frees up working memory resources for reading comprehension. Thus, the ability for readers to read a text with accuracy and sufficient speed is a good indicator of their overall reading ability (word recognition and reading comprehension) (Fuchs et al., 2001).

Text reading fluency is most often measured by asking participants to read a grade level passage out loud for one minute (the one-minute test). The number of words read in the minute is recorded along with any errors. The total number of errors is subtracted from the number of words attempted to give a correct words per minute (cwpm) score. These scores are compared to national norms for children in the same grade and semester. For example, Hasbrouck and Tindal (2006) report norms for United States English reading by specifying cwpm at different percentiles of reading. They recommend a minimum benchmark of 40 cwpm by end of first grade based on previous research. For grades 2 – 8 they refer to 'normal' or expected reading fluency rates of the median score (50^{th} percentile) for that grade and semester give or take 10 cwpm. For grade 2, the expected range is 79 – 99 cwpm by academic year end, and for third grade the expected range is 97 – 117 cwpm by academic year end. Children whose scores fall under these ranges should receive targeted support as they are likely to struggle with word recognition and, therefore, with reading comprehension.

The one minute test has also been used to assess text reading fluency in African contexts in African languages and English as an additional language as part of the EGRA (Dubeck & Gove, 2015). The Department of Basic Education in South Africa has recently released text reading fluency benchmarks. In Nguni languages, which include isiXhosa and isiZulu, the benchmark is 20 cwpm by end of grade 2, and 35 cwpm by end of grade 3 (Ardington et al., 2020b). Fewer words per minute are expected in Nguni languages because of the orthography of Nguni languages, where words are much longer on average than English words and place more demands on morphological processing due to the agglutinating nature of these languages (Land, 2016). In English as an additional language, the oral reading fluency benchmarks are 30 cwpm by end of grade 2, and 50 cwpm by end of grade 3 (Wills, Ardington, Pretorius, et al., 2022). Because learners are reading in an additional language, the English benchmarks are lower than what is reported for monolingual American English learners, i.e., 97 - 117 cwpm for third grade. The South African benchmarks are best thought of as minimum levels of performance in oral reading fluency that learners need to meet to enable reading comprehension.

2.2.1.6 Reading comprehension

Reading comprehension refers to the ability to understand text and is the goal of reading as it supports readers in reading to learn (Pretorius & Currin, 2010). Reading comprehension is the result of code related reading skills (orthographic knowledge, decoding, reading fluency, PA), oral language knowledge (vocabulary, listening comprehension, syntactic knowledge, morphological knowledge) (see Simple View of Reading in section 2.2.2.4), general or background knowledge and other cognitive dimensions (such as inferencing and working memory) (Kim, 2020a). The predictors of reading comprehension change over reading development. At first, when code related skills are still being developed (and are not yet automatic), these skills play a large role in reading comprehension. At later stages of reading ability, once reading is fluent, oral language ability and general knowledge play a larger role (Kim, 2020a).

Reading comprehension can be measured in a variety of ways using different standardized (norm-referenced) commercially made and non-standardized researcher made tests. There are various standardized tests for reading comprehension in English (e.g., Gates–MacGinitie Reading Test, Gray Oral Reading Test, Woodcock–Johnson Passage Comprehension–3) that can be used with children across the grades. These tests do not measure reading comprehension in the same way, and their use does not guarantee that the correct decisions will be made. For example, Keenan and Meenan (2014) found that the children identified as having a reading comprehension deficit (being at or below the 10^{th} percentile) depended on which standardized reading comprehension test was used. This was because different standardized reading comprehension tests place different demands on decoding and language abilities. Reading comprehension tests can also be criterion referenced. For example, the International Institute for Education creates a reading comprehension test every four years in various languages to use in the Progress in International

Reading and Literacy Study (PIRLS). Commercially made tests are not used widely in South Africa so researchers tend to make their own reading comprehension tests.

The EGRA has been used in studies with smaller and very large sample sizes in South Africa to measure reading comprehension. Although it is not a standardized test in the sense that it has been norm or criterion referenced, it does have standardised administration procedures. The oral reading fluency task in EGRA is followed by approximately five reading comprehension questions. Written reading comprehension tests are also used as an additional measure of reading comprehension, for example in the Second Early Grade Reading Study (EGRS 2) (Cilliers et al., 2022). Because these tests are so brief, they do not capture all aspects of reading comprehension, have reduced variation in scores (many zero scores), and often have low internal reliability, especially in languages other than English (Zuilkowski, Piper, et al., 2019). For example, the Cronbach's alpha internal consistency estimate for Kiswahili for a five question comprehension task following oral reading fluency was .44 (Zuilkowski, Piper, et al., 2019). Nevertheless, it is possible to get acceptable reliability in these tasks. The Cronbach's alpha for an isiZulu/Siswati reading comprehension task in the EGRS 2 was .84 for oral questions after oral reading and .79 for written questions after silent reading (Wilsenach & Schaefer, 2022). Even when reliability is acceptable, these tasks elicit many zero scores mostly due to the educational settings for which these tests are used, where many children are not yet fluent readers, even by grade 3. For example, in the sub-sample of EGRS 2 participants reported by Wilsenach and Schaefer (2022) about a third of participants (out of 321 participants) scored zero on the oral or written comprehension task in third grade. These results are not an artifact of the testing method used. The PIRLS study also found that many children in South Africa cannot read for meaning after four years of schooling (Howie et al., 2017).

2.2.1.7 Emergent writing

Emergent writing refers to the early attempts at writing of children before they begin formal schooling. This includes using scribbles or pictures to convey meaning, letter-like writing and letter writing, name writing, and spelling real words (whether with invented, partial or complete representation of all sounds) (Campbell et al., 2019; Puranik & Lonigan, 2014). Emergent writing skills are a precursor for later spelling and writing skills (O' Carroll, 2011; Puranik & Lonigan, 2014), and help to bolster reading through cementing orthography-phonology correspondences (Ehri, 2020).

Puranik and Lonigan (2014) propose that early writing knowledge consists of three types of knowledge which include conceptual, procedural, and generative knowledge. Conceptual knowledge refers to knowledge about how writing represents speech. This domain includes knowledge about the alphabetic principle, how writing is presented linearly (e.g., from left to right in English, isiXhosa, and isiZulu), and knowledge about what writing is for (i.e., to communicate meaning). Procedural knowledge refers to knowledge about specific graphemes and how they correspond to phonemes. This domain includes name writing, letter writing and spelling. Generative knowledge refers to children's ability to convey meaning through writing and includes children's ability to write at the phrase or sentence level. A confirmatory factor analysis model confirmed this three-factor model and revealed a strong correlation between conceptual knowledge and procedural knowledge. Generative knowledge had a weak correlation with both conceptual and procedural knowledge. In their discussion, Puranik and Lonigan (2014) suggest that procedural knowledge is most likely to be related to later spelling and writing ability because this knowledge domain is closely related to letter-sound correspondence knowledge.

Learning how to write one's name is one of the earliest skills that catapults emergent writing (Puranik & Lonigan, 2014) and is moderately correlated (r = .49) with decoding skills longitudinally (Lonigan et al., 2008). Learning how to write one's name boosts children's awareness of the alphabetic principle, and children can often use the letters in their name to learn to write. In a correlational study in a low-income area in South Africa, Wilsenach (2015) found that name writing had a strong correlation with phoneme-grapheme (sound-letter) correspondence knowledge, and a moderate correlation with grapheme-phoneme (letter-sound) knowledge for Northern-Sotho English emergent bilingual first graders. Likewise, Makaure (2021) found a similar moderate correlation between name writing and letter-sound knowledge for a comparable group of children, as well as a strong correlation with word reading. Thus, children's early knowledge of writing (which they can also gain through learning how to write their names), is correlated with later reading ability. After learning to write their name, children require consolidated letter-sound and sound-letter knowledge for their later writing development (Campbell et al., 2019).

2.2.1.8 Spelling

Spelling refers to the conventional way of writing in an orthography, and its development lags behind that of reading (Treiman, 2018). To spell correctly, children need to integrate what they know about phonology, orthography, vocabulary, morphology and syntax (Alcock & Ngorosho, 2007). Word spellings are sometimes consistent with phonology (how the word is pronounced) but sometimes word spellings reflect morphology. For example, in English, the plural *-s* is realized as /s/ in *cats* (which is the same as how the word is pronounced), but /z/ in *dogs* (where the spelling preserves the morphological information of plural *-s* and not the phonological pronunciation of *dogs*). The beginner speller needs to learn when phonological and morphological spelling takes precedence for a variety of words.

For African languages, the difficulty in spelling lies in that there are more phonemes than letters to represent them, which results in the use of multi-letter groups to represent single sounds. These letter groups are more likely to be spelled incorrectly (Alcock & Ngorosho, 2007; Daries & Probert, 2020). One would think that word length may be an additional factor in African language spelling because of the agglutinating nature of the language which leads to long words. However, existing evidence does not support this idea: word length was not related to the number of spelling errors in isiXhosa (Daries & Probert, 2020), and in Kiswahili, shorter words were more difficult to spell than longer words (Alcock & Ngorosho, 2007). Cox (2022) explored spelling accuracy by examining the unique effects of orthographic neighbourhood density and orthographic neighbourhood frequency, and word length as measured in syllables and in letters. Cox (2022) found that words with more letters, controlling for number of syllables, were more difficult to spell than words with the same number of syllables but with fewer letters. For example, a three-syllable word like *ngaphandle* with 10 letters was spelled incorrectly more often than a four-syllable word such as *elusizi* which has 7 letters. Thus, the number of graphemes used to represent consonant phonemes in isiXhosa increases spelling difficulty, even in a consistently written orthography, thereby mirroring the findings on digraph and trigraph reading (Ardington & Meiring, 2020).

2.2.2 Theories of reading development and skilled reading

The sections below present an overview of the major theories that seek to explain how reading and spelling develop. The phase theory of reading and spelling development and the dual route model of reading seek to explain how word recognition moves from phonological decoding to automatic word recognition. The role of orthographic depth is addressed with reference to the orthographic depth hypothesis. These theories inform the psycholinguistic grain size theory which provides a more comprehensive account of how skilled reading develops, considering aspects of phonology and orthography. After these theories of word recognition, the simple view of reading, which accounts for reading comprehension, is addressed.

2.2.2.1 Phase Theory of reading and spelling development

Ehri (1987, 2005, 2020) proposed that word recognition and spelling develop in four phases which are overlapping rather than discrete. In the first phase of learning to read, called the pre-alphabetic phase, readers rely on visual and other cues (but not alphabetic cues) for word reading, e.g., recognizing the word for *camel* because of the two humps on the *m* (Ehri, 2005). Although children in this phase can recognize some salient words (such as brand names like *Coca Cola*) from their context, they cannot read unfamiliar words and are non-readers. In the second phase, called the partial alphabetic phase, readers know some letter-sound correspondences for consonants, and do not really know the correspondences for vowels. When they read or spell words, they pay attention to the letters at the start and end of words. During the partial alphabetic phase, novice readers have not yet developed knowledge of all grapheme-phoneme correspondences, so words are not analysed into their individual phonemes. Novice readers in this phase are still not able to read unfamiliar words. In the third phase, the alphabetic phase, readers know and start to use grapheme-phoneme correspondences automatically to decode and spell (even unfamiliar) words. With increased reading practice, readers begin to process some words lexically because the orthographic forms of these words are stored in memory. In the fourth phase, the consolidated alphabetic phase, readers have stored lexical spellings in long term memory, and incorporate larger units than letter-sound correspondences, such as syllables and/or morphemes, in word reading. As readers gain experience, they read familiar words faster and more accurately than unfamiliar words and nonwords. This phenomenon is called the lexicality effect and indicates that unfamiliar and nonwords are processed via a sub-lexical (grapheme-phoneme) route (Caravolas, 2018).

2.2.2.2 *Dual route model of word recognition and the orthographic depth hypothesis*

The dual route model (Coltheart et al., 1993, 2001) proposes that there are two routes to word recognition. The first route is sub-lexical, i.e., converting words via grapheme-phoneme correspondences to their pronunciation and then semantic access. The second route is lexical and is a direct path from the orthographic representation of the word to its pronunciation/meaning. The sub-lexical route allows reading of nonwords and consistently spelled words (but not exception words) and the lexical route allows reading of exception and regular words (Coltheart et al., 1993).

The orthographic depth hypothesis extends (L. Katz & Frost, 1992) the dual route model to explain reading cross-linguistically. This hypothesis states that the route used to read words will depend on orthographic depth. Readers of consistent orthographies will rely more on the sub-lexical route, and readers of inconsistent orthographies will rely more on the lexical route. Thus, PA is theorised to be involved more for reading in consistent orthographies. However, we now know that phonological information is implicated in reading across orthographies (Verhoeven & Perfetti, 2017) and that the use of one route over another may be due to familiarity with the word, or general reading ability (Share, 2008).

2.2.2.3 *Psycholinguistic grain size theory of the development of word recognition*

A critique of both the dual route model and phase theory is that they were derived from the need to explain English reading. English is an outlier alphabetic orthography because it is more inconsistent than most languages in its orthography-phonology relations (Share, 2008). Additionally, these theories do not explicitly address how words progress from being unfamiliar to familiar, and how readers move from being novice to experienced readers (Share, 2008).

The psycholinguistic grain size theory (PGST) of word recognition (Ziegler & Goswami, 2005) aims to provide an explanation of reading development that applies cross-linguistically by referring to how novice readers learn to map the phonology of their language to the orthography of how that language is written down. This theory explains how children phonologically recode using various grain sizes. Small grain sizes are those which are phoneme-grapheme correspondences, with larger grain sizes occurring at the rime and syllable level. For efficient phonological recoding to take place, readers must work out the most consistent matching of available phonological units with orthographic units for the language they are learning to read in. This matching can become complicated for three reasons: phonological unit availability, orthographic consistency, and the number of orthographic grains to be learned.

The first problem, that of the availability of phonological units, is that readers do not always have awareness of the phonological units needed for reading in their language. For languages written alphabetically, where letters represent phonemes, phoneme awareness is needed. If the phonological units needed to read a language are not yet available to the reader, this awareness must be developed – this is true for almost all readers, as most people do not acquire awareness of phonemes until they receive formal literacy instruction (e.g., Morais et al., 1979). The phonology of the language, specifically the syllable structure, can enhance the awareness of phonological units of different sizes. For example, languages with open syllables (such as Italian and Northern Sotho) encourage the awareness of syllables (Cossu & Katz, 1988; Wilsenach, 2019) and languages with complex syllable structures (such as Czech) encourage the awareness of phonemes (Caravolas & Bruck, 1993).

The reader is also faced with problems of orthographic consistency. While previous conceptualisations of orthographic depth addressed only orthographic consistency at the letter-phoneme level, the PGST refers to orthographic consistency at different levels, such as the rime, or syllable levels. English, for example, is less consistent at the letter-phoneme level: *a* is pronounced differently in *cat* [kæt], *was* [wɔz], *saw* [soː], *made* [meɪd] and *car* [kɑː] (examples from Ziegler and Goswami, 2005, p. 10). However, English is more consistent at the rime level: the rime *-at* is always pronounced [æt] in words such as *cat*, *rat*, *sat*, *hat*, *mat*, *flat*. Thus, a novice reader must learn which orthographic units and the phonological units they represent are the most consistent in specific words and their language in general. The novice reader, then, needs to develop different phonological recoding strategies that best suit the words and language(s) they are reading.

Finally, the problems of phonological availability and orthographic consistency interact to create the problem of granularity. Granularity refers to the number of phonology-orthography mappings to be learned (Goswami, 2010). It is easier to learn to read when phonology and orthography relations are at small grain sizes (phonemes and graphemes), than at larger grain sizes (rimes, syllables, and words) because there are fewer correspondences to learn at small grain sizes.

Ziegler and Goswami (2005) argue that the speed of literacy acquisition is a consequence of how efficient the reader solves these three problems. In summary, the theory explains how readers in all languages find the most efficient and consistent correspondences between the phonological units available to them (usually at large grain sizes), and the orthographic units used by their writing system, (in alphabets this is the small grain size, the letter). Readers will develop the most efficient correspondences for phonological recoding which can include both large and small grain sizes. The PGST predicts then that reading acquisition will take place much more quickly in consistent than inconsistent orthographies because the granularity is lower in consistent orthographies, i.e., there are fewer phonology-orthography correspondences to learn because there is consistency at both small and larger grain sizes.

With regard to the Nguni languages that are the focus in this study, the PGST predicts that isiXhosa and isiZulu should be read with a small grain size (phoneme – grapheme units) because the orthographies of these languages are consistent. While these languages privilege the availability of the syllable because of the open syllable structure (Diemer et al., 2015) the consistent letter-phoneme mappings should ameliorate the awareness to phonemes and therefore reading acquisition. Nevertheless, the granularity the reader is exposed to is higher than in other consistent orthographies because many more consonants need to be represented in writing than there are letters. The 26 letters are used to represent 50 or more phonemes (addressed in section 3.6). Thus, consistency in small grain sizes (letter-phoneme correspondences) does not overlap with lower granularity, necessarily. isiXhosa and isiZulu readers will need to learn the single letters and letter groups (digraphs, trigraphs and quadgraphs) which represent the sounds of their language, which are demonstrated to make reading (Ardington & Meiring, 2020) and spelling (Cox, 2022) more difficult.

Overall, the PGST explains how readers move from sub-lexical recoding strategies[8] (which include the letter, rime, and syllable levels) to lexical recoding strategies. These different recoding strategies may be used for different words within the same orthography/language, and there may also be a shift in recoding strategies over time as readers become more familiar with reading.

2.2.2.4 Simple view of reading

So far, theories related to the development of word reading have been addressed. The Simple View of Reading, proposed by Gough and Tunmer (1986) explains the components of reading comprehension. In this theory, reading comprehension results from the product of decoding and linguistic comprehension: $R = D \times C$. In this view, decoding includes nonword decoding and word recognition (Protopapas et al., 2012). Decoding refers to code-dependent or reading specific skills (Florit & Cain, 2011). Linguistic comprehension refers to the ability to understand linguistic information at the lexical level (i.e., vocabulary), sentence and discourse levels (Gough & Tunmer, 1986). These abilities are used for understanding both spoken and written language. Linguistic comprehension is measured via tasks of listening comprehension, vocabulary and verbal reasoning (Lonigan et al., 2018). Together, both decoding and linguistic comprehension account for variance in reading comprehension, but neither are sufficient on their own to explain reading comprehension. Thus, reading failure can be explained with reference to either of these domains. Using this model, Gough and Tunmer (1986) propose that poor decoding skills and adequate linguistic comprehension are hallmarks of dyslexic readers, very good decoding skills with low linguistic comprehension are hallmarks of hyperlexia, and poor skills in both decoding and linguistic comprehension results in 'garden variety' poor readers. The usefulness of this model lies in its simplicity as educators can identify the relative strengths and weakness of the readers in their classrooms and provide support in decoding, linguistic comprehension or both (Florit & Cain, 2011).

Although the model was first proposed to explain reading difficulties, it can also be used to understand the development of reading comprehension over time (Lonigan et al., 2018). With regards to reading comprehension development, the simple view of reading proposes a gradual shift in the contribution of decoding and linguistic comprehension to reading comprehension over time or grade level. That is, the variance explained by decoding and linguistic comprehension in reading comprehension changes across reading development. At early grades, or in the early

[8] In the Dual Route Model, the authors indicate that using the rime in reading is part of the lexical level (Coltheart et al., 1993) but the PGST places the rime level as a sub-lexical recoding strategy, which is the position I also take.

stages of learning to read, reading comprehension is most constrained by decoding skills so decoding skills make a larger contribution than linguistic comprehension to reading comprehension (Lonigan et al., 2018). As children become more automatic at word recognition/decoding, linguistic comprehension explains more variance in reading comprehension (Erbeli & Joshi, 2022; Lonigan et al., 2018).

This simple view of reading functions as a useful heuristic in understanding the importance of both decoding and linguistic comprehension for reading comprehension. Criticism of this model of reading are that the model underspecifies which aspects of word recognition and language comprehension are related to reading comprehension, and does not address how background knowledge may also affect reading comprehension (Duke & Cartwright, 2021). Other researchers have built on the simple view of reading to explicate these other components including Scarborough's reading rope (Scarborough, 2009) and Kim's Direct and Indirect Effects Model of Reading (Kim, 2020b). These two models provide more specificity about which aspects of oral language and decoding contribute to reading comprehension. These two models are not reviewed in detail since they rest on the same main claim of the Simple View of Reading (that reading comprehension is the product of oral language knowledge and decoding ability) and because the primary aim of the present study is not to identify the exact components that relate to reading comprehension.

2.2.3 Additional language literacy development

Learning how to read in more than one language can be more complex than learning to read in one language. The reason for this is that different languages have different linguistic systems, as well as differing (and even contradicting) orthographic rules (Koda, 2007). Another factor that influences this complexity is whether the additional language is known at speaking and listening level, before a learner starts learning how to read and write in it (Mirza & Gottardo, 2022). Nevertheless, the same principles apply to both first and additional language literacy: learning how to read and spell relies on an understanding that print represents speech, and that spoken language represents both sound and meaning (see sections 2.2.1.1 and 2.2.1.2).

Koda (2007) offers three considerations when exploring additional language literacy development: (1) literacy is a skill which relies on several sub-skills or precursor skills, (2) literacy sub-skills or precursor skills rely on certain linguistic knowledge, and (3) for additional language reading, these subskills or precursor skills need to be developed in two (or more) languages. These sub-skills include PA, orthographic awareness, morphological awareness, syntactic awareness, and vocabulary knowledge. However, researchers disagree on the third point about whether these sub-skills need to be developed once and contribute to literacy in any language, or whether these sub-skills are language specific. In earlier research, two hypotheses were used to interpret findings on bilingual literacy development. These were the script dependent hypothesis and the central processing hypothesis (Geva & Siegel, 2000). The script dependent hypothesis, which derives from the orthographic depth hypothesis mentioned in section 2.2.4, suggests that literacy development of bilingual readers will develop faster in the more consistent orthography. The central processing hypothesis suggests that the same skills, including PA, RAN and working memory, underlie reading in both L1 and L2. For example, Geva and Siegel (2000) examined the predictors of word recognition and decoding. They found that reading accuracy developed faster in L2, Hebrew, which was written with a consistent script, compared to English. However, short term memory in each language supported reading in L1 and L2. Thus, these central processing and script dependent hypotheses are complementary: L1 and L2 reading development are affected both by orthographic depth and underlying cognitive and phonological processing skills. Koda's (2007) considerations play a role here too. Because phonological processing skills, especially PA, are influenced by language structure, people learning to read in two or more languages will sometimes need to develop additional skills which are necessary for the L2, and not necessarily developed in L1. For example, children learning to read in Spanish, a consistently written orthography, quickly develop PA because of the high correspondence between letters and sounds. When these children learn to read in English, they have to develop awareness of larger orthographic units such as rimes and morphemes which are more consistent than the letter level (Ziegler & Goswami, 2005).

The idea that literacy skills can be shared across languages is largely supported by existing research. For instance, a meta-analysis of 22 effect sizes found a moderate to strong positive correlation ($r = .49$, 95% CI [.34, .62]) between first and additional language decoding ability (Melby-Lervåg & Lervåg, 2011). There was significant heterogeneity in the effect size: samples who received both L1 and L2 instruction had stronger correlations between L1 and L2 decoding than samples who had L2 only instruction. In South Africa, more English literacy instruction while L1 literacy is supported is associated with stronger correlations between L1 and L2 word reading. The correlation between L1 and L2 text reading was $r = .67$ for an L1 instruction group and $r = .80$ for an English instruction group of Northern Sotho-English emergent bilinguals (Makaure, 2021). This could be explained by more familiarity with English vocabulary and orthographic forms for children who receive more English literacy instruction. If children are familiar with English, then their L1 and English L2 reading skills will develop similarly. However, when children receive less instruction in English literacy, they may remain slow English readers, even if they are good L1 readers. It would also be expected that children who receive L2 only literacy instruction, and no or little L1 literacy instruction, would also have a weaker correlation between L1 and L2 reading, potentially because of lower familiarity with the orthographic representation of the L1 oral language, and/or the application of L2 reading strategies (e.g., whole word recognition) that do not support L1 word recognition (Probert & De Vos, 2016).

A meta-analysis of 22 effect sizes of the L1 and L2 reading comprehension correlation also reported a moderate to strong correlation (r = .50, 95% CI [.30 - .66]) (Jeon & Yamashita, 2014). There was significant heterogeneity in this estimate: the extent that L1 and L2 were from different language families was a moderator. In this analysis by Jeon and Yamashita (2014), studies which included correlations between two Indo-European languages had higher correlations (r = .60, 95% CI [.42, .73]) than languages which came from different language families (r = .36, 95% CI [.32, .49]). Correlations between reading comprehension in L1 and L2 in South Africa are also moderate. For example, Wilsenach and Schaefer (2022) reported that L1 and L2 comprehension was correlated at r = .55 for oral comprehension questions, and r = .67 for written comprehension questions. Thus, reading skill is more likely to be correlated with MOI in both L1 and L2, and when the languages share structural similarities.

While the same skills underlie reading development, oral language ability is less likely to be shared between L1 and L2, especially if languages are from different language families with few cognates. Thus, while code-related skills such as decoding may be on par in children's first and additional language, reading comprehension may lag, compared to monolinguals with the same decoding ability (Gunnerud et al., 2022). This is because additional language readers often have limited oral language proficiency in the additional language (August et al., 2005)[9], implying that lags in reading comprehension are due to language rather than reading delays (Jeon & Yamashita, 2014). Limited oral language proficiency can also constrain the speed at which language specific metalinguistic skills are developed in the additional language (Koda, 2007). In South Africa, many children start to learn English only from first grade, and are expected to be able to speak and read English independently from fourth grade. Wilsenach (2015) found that grade 1 Northern Sotho – English emergent bilingual children, attending English and Northern Sotho MOI schools respectively, had standard scores of 56 and 51, respectively on the Peabody Picture Vocabulary

[9] An exception here is Peets et al. (2022) who found no bilingual disadvantage on reading comprehension for middle-class bilingual children compared to monolinguals, even though the bilingual children had slightly lower vocabulary. This result may reflect the language status of the children. The bilingual sample had more supportive home literacy practices than the monolingual sample, whereas most other studies sample emergent bilinguals, and do not report home literacy practices.

Test. These scores represent 3 to 4 standard deviations below the norm, highlighting that these children need additional support in their English development to succeed later in school. Findings at the third grade level are equally bleak. Pretorius and Stoffelsma (2017) compared the English vocabulary knowledge of first and additional language children. They found that the additional language learners knew half as many words as their monolingual peers and the gap remained consistent over the course of the school year. These gaps in vocabulary knowledge in English present challenges for reading comprehension development in English.

In summary, additional language literacy development is more complex than first language literacy development because of the involvement of two language systems, and differences in orthography between the two languages. While precursor skills related to decoding are more easily shared across languages, and there are strong correlations between first and additional language decoding skills, reading comprehension in the additional language can remain constrained due to lower oral language proficiency in the additional language. Nevertheless, the same sub-skills are related to reading comprehension in L2: both L2 decoding and L2 vocabulary support L2 reading comprehension (Melby-Lervåg & Lervåg, 2011).

2.2.4 Theories of cross-language transfer

Earlier, I referred to the script dependent hypothesis and central processing hypothesis which seek to explain what affects reading development in L2. These hypotheses are complementary with the script dependent hypothesis suggesting that the differences in scripts play a role in literacy development, and the central processing hypothesis suggesting that the same underlying skills are related to literacy in L1 and L2 (Geva & Siegel, 2000). The other hypotheses often used in bilingual research are the Threshold Hypothesis and the Linguistic Interdependence Hypothesis.

Cummins (1979) proposed the threshold hypothesis and the linguistic interdependence hypothesis to explain the language and academic achievement of bilingual students who showed patterns of additive and subtractive bilingualism. He observed that children with a firm L1 foundation had good outcomes when learning an L2 in immersion settings, but children of minority language status had poor progress in both L1 and L2 when instructed in L2 only. Four decades ago, this phenomenon was attributed to the different SES of the immigrant children among other factors (such as attitude, or language prestige), but Cummins proposed a framework which specified the interaction between bilingual children's linguistic abilities and instructional environment.

The threshold hypothesis states that children need to attain a certain level of proficiency in both their L1[10] and their L2 before any negative effects of bilingualism can be avoided and before cognitive benefits from bilingualism and bilingual education can be attained (Cummins, 1979). Cummins (1979) proposed two thresholds: a lower and higher threshold. The lower threshold is where children are proficient in neither L1 nor L2, and therefore have insufficient ability to interact successfully in their educational environment. Cummins (1979) proposes that children below the lower threshold will have negative consequences from bilingual education. For example, this may be the case when isiZulu speaking toddlers are sent to English play schools and when L1 support is not provided at home. The higher threshold is a level where children have adequate proficiency in both L1 and L2 such that they benefit from bilingual education. For example, this is the case in mother tongue based bilingual education, where the L1 is supported extensively and L2 is introduced gradually. Children above the lower threshold but below the higher threshold have L1 proficiency but not yet adequate proficiency in L2. This hypothesis predicts that these children would have neither positive nor negative effects from bilingual education. Cummins (1979, p. 230) stated that "[t]he threshold cannot be defined in absolute terms", and this lack of concreteness and falsifiability is a major criticism of the threshold hypothesis (Berthele & Vanhove, 2020).

The Developmental Interdependence Hypothesis, commonly referred to as the Linguistic Interdependence Hypothesis, should be considered jointly with the Threshold Hypothesis. The Linguistic Interdependence Hypothesis states that L2 proficiency is dependent on L1 proficiency i.e. that L1 abilities underlie or transfer to L2 (Cummins, 1979). Cummins (1979) specifically mentions the importance of conceptual and lexical knowledge, metalinguistic skills, and decontextualized language in L1 which can support L2 literacy. Instruction can play a role in supporting bilinguals' L1 and L2 development, such that instruction which focuses on these factors makes them more amenable to transfer (e.g., Kim & Piper, 2019). Additionally, Cummins (1979) proposes that children's attitudes to language can further affect bilingual development with positive attitudes to a language leading to more gains in that language, and negative attitudes to a language leading to slower or no growth in that language. Cummins (1996) summarises the hypothesis as follows:

> To the extent that instruction in Lx is effective in promoting proficiency in Lx, transfer of this proficiency to Ly will occur provided there is adequate

[10] The article first mentions that L2 proficiency should be considered for the threshold. However, Cummins' (1979) discussion about the lower and higher threshold makes it clear that both L1 and L2 proficiency should be considered in this hypothesis.

exposure to Ly (either in school or environment) and adequate motivation to learn Ly. (Cummins 1996, p. 111)

Thus, Cummins proposes a common underlying proficiency which arises from the L1 but supports literacy in both languages. This underlying proficiency includes linguistic and conceptual knowledge available for both languages, even if the two languages are quite different from one another. It is the common underlying proficiency which enables transfer among languages (Cummins, 2017). According to Cummins (2017), there are six main forms of cross-linguistic transfer, which includes transfer of conceptual knowledge, linguistic knowledge (e.g., being able to decompose words into their parts), morphological awareness, PA, learning strategies, and pragmatic knowledge of language use.

Evidence for transfer comes in different forms, which include group comparisons, cross-sectional correlation or covariance analysis, and longitudinal correlation or covariance analysis (Berthele & Vanhove, 2020). In group comparison research designs, the means attained in each language by groups of children in different educational programs are compared e.g., student achievement in a program that supports L1 is compared to student achievement in a program that supports L2. Most of these types of studies use a quasi-experimental design since randomly assigning children to classes and programs is difficult, but random control trials are the gold standard to derive evidence for language transfer using group designs (Berthele & Vanhove, 2020). There is some evidence of language transfer using randomised control trials in South Africa. For example, the first EGRS supported L1 Setswana language and literacy instruction and found that children in the treatment (i.e. enhanced support for L1 instruction) had advantages in literacy in L1 (Setswana) and L2 (English) compared to children in control schools where the L1 may not have been supported as systematically (Taylor et al., 2017). In comparison, the EGRS 2 supported L2 English instruction, with no systematic support for L1 (isiZulu or Siswati). The evaluation found that children in the treatment schools gained English language skills compared to children in the control schools with a null effect on English literacy (Cilliers et al., 2020). However, L1 literacy skills were lower in the treatment school than the control schools (Cilliers et al., 2020).

When using cross-sectional correlational analysis to analyse transfer, a strong concurrent correlation between related skills in each language is interpreted to indicate language transfer. For example, Cummins (1979) uses correlational evidence to infer that transfer takes place from L1 to L2 citing a UNESCO report that found a moderate-to-strong correlation between Cree oral language competence and English reading comprehension. Correlations between skills measured in each language at different points in time can also be used as evidence for language transfer. Regression analyses, including linear mixed effects models, are also used to determine language transfer concurrently or longitudinally. Using this analysis, there is evidence of language transfer when skill "a" in Lx is significantly related to skill "b" in Ly after controlling for skill "a" in Ly. For example, Shin et al. (2015) used linear mixed effects modelling to determine the effect of Chichewa reading on English reading a year later, after controlling for English reading at the first time point. A significant coefficient of Chichewa time 1 reading on English time 2 reading was interpreted as evidence for transfer. In another longitudinal study, Berthele and Vanhove (2020) used model fit to determine whether cross-linguistic transfer took place from reading in two languages at two time points. A model which included only same language predictors from the previous time point was compared to a model with included both language predictors from the previous time point. If the model which included cross-linguistic predictors had better fit, then the results were taken as evidence of language transfer.

Finally, path analysis and structural equation modelling (SEM) have been used as covariance analyses to model cross-language transfer. These analyses allow for simultaneous modelling of various causal relations, and the former (SEM) also accounts for measurement error. In these models, evidence for cross language transfer comes from the statistical significance and strength of the coefficients from skill "a" in Lx to skill "a" in Ly after accounting for earlier abilities in the skills in each language, and the covariation of the skills at the current point in time. For example, Kim and Piper (2019) use cross-lagged paths models which included autoregressive paths to determine cross-language transfer between Kiswahili and English reading and vice versa. They interpreted significant cross-language path coefficients as evidence for language transfer. Group comparison can also be done within this analytic approach by using multiple group analysis as Kim and Piper (2019) have done to compare children in treatment and control schools.

In summary, various analytic approaches have been used to provide evidence for cross-language transfer using the Interdependence Hypothesis. In group comparison, the difference in means between groups are compared on skills of interest in each language, with differences being attributed to transfer affected by instruction. With regards to correlation analysis, the strength of the correlation between variables in each language has been used in correlation analysis. With regards to regression analysis and its variations, significant coefficients from Lx to Ly after controlling for earlier abilities in each language, and a significant change in model fit when comparing models with and without cross-linguistic terms has been used as evidence for cross-language transfer.

2.3 VOCABULARY

Oral language ability forms the basis of learning to read and write, as the written word represents spoken language. Oral language knowledge is used in listening comprehension and includes knowledge from a number of domains such as vocabulary knowledge, syntactic knowledge, morphological knowledge, and pragmatic knowledge (Metsala et al., 2021). Because of the scope of this study, I refer to only one aspect of oral language ability, namely vocabulary.

2.3.1 Definition

The multidimensional construct of vocabulary refers to word knowledge; specifically knowledge of the form, meaning and use of words and word units (Nation, 2013). Vocabulary knowledge includes both breadth of knowledge (how many words are known) and depth of knowledge (how well words are known, or the quality of the word knowledge) (Schmitt, 2014). Vocabulary breadth is often conceptualized as the number of word forms (spoken or written) linked to word meanings, while vocabulary depth includes information about a words' derivations, associations and collocations (i.e., the words it frequently occurs with) (Schmitt, 2014). Both breadth and depth of knowledge exist on a continuum of receptive to productive knowledge. That is, some words are known receptively only (can be understood but not used productively in speech or in writing), while other words are also known productively (are understood and used). Receptive vocabulary precedes productive vocabulary: words are first understood in listening and reading, before they can be used in speaking and writing (Schmitt, 2014, 2019). Receptive vocabularies have more breadth (are larger) than productive vocabularies for monolingual and multilingual children (Gibson et al., 2012; Nation, 2013).

2.3.2 How vocabulary is related to reading and writing

As mentioned in section 2.2.1.6, vocabulary knowledge supports reading comprehension because reading comprehension relies, amongst other things, on accessing the lexical representations of words via word recognition. Vocabulary has stronger correlations with reading comprehension within, rather than across language: L1 vocabulary supports L1 reading comprehension (Lee, 2011), L2 vocabulary supports L2 reading comprehension (Jeon & Yamashita, 2014; Songshan Zhang & Zhang, 2020), but cross-language relations (L1 vocabulary – L2 reading comprehension or L2 vocabulary – L1 reading comprehension are often much weaker. For example, in their meta-analysis, Melby-Lervåg and Lervåg (2011) reported a moderate correlation ($r = .46$, 95% CI [.33, .57]) between L2 vocabulary and L2 reading comprehension based on a meta-analysis of eight effect sizes. Jeon and Yamashita (2014), in their meta-analysis, found an even stronger correlation of $r = .79$, based on 31 effect sizes, between L2 vocabulary and L2 reading comprehension. In comparison, a very weak and non-significant correlation between L1 vocabulary and L2 reading comprehension ($r = .04$, 95% CI [-.10, .17]) was reported by Melby-Lervåg and Lervåg (2011). These correlations could be context specific.

Research shows that readers need to know about 98% of the word families[11] in a text in order to understand it; this requires knowledge of about 6000 to 9000 word families (Nation, 2006). Such precise estimates and their relation to education have not been extensively examined for African languages. The introduction to an isiZulu school dictionary does however mention that the first 5000 headwords covers 71% of words in the isiZulu corpus from which the dictionary was built (de Schryver, 2014). Similar estimates were not provided in the isiXhosa publication. Research on additional language learners of English finds that these vocabulary estimates are not met. For example, Schmitt (2008) reviews studies of university students' vocabulary size finding that many of them know fewer than 3000 word families in English, even after 1000 hours of instruction. In South Africa, university students are also found to have mastered less than 3000 high frequency word families (Scheepers, 2016). Once decoding and word recognition skills are established, vocabulary knowledge is the largest constraint on reading comprehension, in line with the simple view of reading (Hoover & Gough, 1990).

Vocabulary knowledge also supports word reading and spelling ability. Vocabulary is used when reading and spelling via the lexical, whole word route. For example, Kim et al. (2014) found that vocabulary made a unique contribution to word reading and spelling after controlling for PA, alphabet knowledge and letter writing automaticity for a group of American kindergarteners. In South Africa, English L2 vocabulary measured at the start of second grade was significantly related to English L2 spelling at the end of third grade for a group of Northern Sotho-English emergent bilinguals (Makaure, 2021).

Reading and writing also support vocabulary development. Readers can learn new words through extensive reading (Hedgcock & Ferris, 2018) and paying attention to words in texts (Schmitt, 2008). In South Africa, exposure to storybook reading was found to provide children with much more varied vocabulary than speech in the third grade (Stoffelsma, 2019a). On the other hand, writing down new words helps readers establish form-meaning connections, which then leads to new words being committed to long-term memory (Schmitt, 2014).

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[11] A word family consists of the base word (e.g., *kick*) and its inflectional forms (e.g., *kicks, kicked, kicking*) and derivational forms (e.g., *kicker*) (Bauer & Nation, 1993). After learning a base form of a word, learning the other word family members is easier.

2.3.3 Vocabulary learning and teaching

Vocabulary is learned incidentally from speech or written input in the environment based on the frequency of words in the language; as well as via explicit instruction (Nation, 2013; Schmitt, 2010). The length and quality of exposure to language in the environment, therefore, plays a role in learning new words. To illustrate the role of length of exposure in vocabulary development I refer to Potgieter and Southwood (2016) who compared the vocabulary size of trilingual isiXhosa-English-Afrikaans speaking children with monolingual Afrikaans, monolingual isiXhosa, and monolingual English speaking children. The trilingual children had smaller vocabularies in Afrikaans and English compared to the monolinguals, because of the lower length of exposure to these languages. The trilinguals' isiXhosa vocabulary size did not differ compared to the isiXhosa monolingual children. Similarly, Wilsenach (2015) found that Northern Sotho speaking first graders attending English MOI schools had larger English vocabularies than their peers at Northern Sotho MOI schools; however, the groups did not differ on Northern Sotho vocabulary size. Wilsenach's (2015) results mirror those of Umbel et al. (1992) who found no significant difference in L1 Spanish vocabulary total score for a group of Spanish-English emergent bilinguals in first grade who had and did not have English exposure at home, but did find significant difference in L2 English, in favour of the group who received some English exposure. Thus, exposure to languages at home and at school affects incidental vocabulary learning.

The relative contribution of incidental and explicit vocabulary learning to total additional language vocabulary learning may depend on the social and educational context. In South Africa, many children, especially in rural contexts, do not have exposure to English outside of the classroom. Motseke (2020), for example, interviewed eight parents of grade 4 to 6 children at one rural Limpopo school to determine what educational support parents provide for their children's English additional language development. A key finding from the interviews was that the parents were unable to or did not speak English at home and heard English seldomly in the community. There were also no English books available at home. In a larger study including both rural and urban parents of 1347 children in Mpumalanga, 28% of parents reported never using English at home, and 40% reported never using English with others (Schaefer & Kotzé, 2019). Thus, for children in these contexts in South Africa, the educational context needs to play an effective role in supporting the English additional language vocabulary learning of students, as they are less likely to be exposed to English in their home environments.

Children generally arrive at school with knowledge of high and mid frequency vocabulary in their L1, and teachers should, thus, focus on explicit instruction of mid and low frequency words as they arise in content subjects (Hedgcock & Ferris, 2018).

On the other hand, additional language learners of English will, depending on their context, need additional support to learn sufficient vocabulary to allow them to understand the texts they read. In this case, teachers should focus on making sure children know high frequency vocabulary so that they can read independently, and then learn additional vocabulary via reading (Hedgcock & Ferris, 2018). Teachers must be selective in what they teach because there is limited classroom time available. At the same time, in order to ensure success, ambitious vocabulary goals must be set for the curriculum (Schmitt, 2008).

2.3.4 The relationship between L1 and L2 vocabulary

Word knowledge entails creating connections between conceptual knowledge (or meaning), and a form (spoken or written word; also called lexical label). Conceptual knowledge of monolinguals and bilinguals may be the same, but bilinguals may only have the meaning-form connection in one language (Dixon et al., 2022). Thus, word knowledge may be distributed across the languages a speaker knows and can produce (Oller et al., 2007; Umbel et al., 1992). Which language the concept may be known in depends on the quantity and quality of language input and types or patterns of language experiences in each language (Oller et al., 2007). It is, therefore, important to consider that bilinguals may have the same conceptual knowledge as monolinguals, but smaller vocabularies in either language due to the distribution of form-meaning links across languages (Jordaan et al., 2021; Umbel et al., 1992). Children who use one language primarily at school and one language at home will often know home based concepts (such as names of fruits, vegetables, and meals) in the home language, and know school related or academic concepts in the school language only (such as the names of shapes and colours). In South Africa, Jordaan et al. (2021) explored how conceptual scoring can provide a better understanding of children's conceptual knowledge. When Afrikaans-English and isiXhosa- English emergent bilinguals were compared to English monolinguals, they had much lower receptive and expressive English vocabulary scores. However, when conceptual scoring was applied (a child gets a point if the word for the concept is known in either language) the conceptual scores of the Afrikaans-English bilinguals was similar to English monolinguals, and the conceptual scores for the isiXhosa-English group was slightly lower than the English monolingual group. While conceptual scoring provides a better estimate of children's conceptual knowledge, vocabulary scores in each language most likely give a better estimate of whether children have the vocabulary needed for reading in either language (Wilsenach & Schaefer, 2022).

Even though vocabulary may be distributed across languages, meta-analyses have found a weak but significant positive correlation ($r = .16$, 95% CI [.07, .24]) between L1 and L2 oral language (operationalized as listening comprehension, and receptive and productive vocabulary) (Melby-Lervåg & Lervåg, 2011). That is, children with larger L1 vocabularies tend to have larger L2 vocabularies. Reasons for this relation are that vocabulary learning aptitude would be used for both languages a child knows, and children with larger L1 vocabularies know more concepts, for which they only need to learn the form in the L2 (De Wilde et al., 2021).

Primary studies which examined only vocabulary have found weak to moderate correlations between L1 and L2 vocabulary in the African context. In South Africa, weak to moderate correlations were found between L1 and L2 receptive vocabulary in grade 1. Wilsenach (2015) reported correlations of r = .33 for a group of grade 1 Northern Sotho-English emergent bilinguals in Northern Sotho instruction, and r = .45 for a group of grade 1 Northern Sotho-English emergent bilinguals in English instruction. A correlation of r = .52 was reported for isiZulu-English and Siswati-English bilinguals for productive vocabulary in third grade (Wilsenach & Schaefer, 2022). Weak to moderate correlations between L1 and L2 vocabulary were also reported in Kenya for preschool children (receptive: r = .36 - .40; productive: r = .43 - .49; Knauer et al., 2019) and for grade 1 (receptive: r = .43; Wawire & Zuilkowski, 2020). In summary, L1 and L2 vocabulary are related, but the strength of this relationship varies from weak to moderate, depending on the context in which the languages are learned.

2.3.5 Vocabulary measurement

The vocabulary of children is most often directly measured using picture tests as answering these tests are not affected by literacy ability (Jeon & Yamashita, 2014). American or British standardized tests that have been used in South Africa include the Peabody Picture Vocabulary Test (Dunn & Dunn, 2007), the Expressive Vocabulary Test (Williams, 2007), and the British Picture Vocabulary Scales (Dunn et al., 2009), for example. Tests developed in South Africa for school age children include the Early Learning Outcomes Measure (Dawes et al., 2020), the Productive Vocabulary Test (Wilsenach et al., 2021; Wilsenach & Schaefer, 2022), and the Ingwavuma Receptive Vocabulary Test (Mazibuko & Chimbari, 2020). Multilingual tests have also been developed in Kenya, e.g., the Kilifi naming test (Kitsao-Wekulo et al., 2019), which allows responses in any language the child knows. For all these tests, children are shown pictures and either have to select the picture that matches the prompt (in a receptive test) or provide the lexical item that matches the picture (in a productive test).

2.4 PHONOLOGICAL PROCESSING AND ITS RELATION TO LITERACY

Phonological processing skills refer to the skills that use the sounds in one's language to process spoken and written language (Anthony et al., 2003). In this thesis, the phonological processing model proposed by Wagner and Torgesen (1987) is adopted. This model informed the Comprehensive Test of Phonological Processes (CTOPP) (Wagner et al., 2013a), which is used in the present study as a measurement instrument. In this model, phonological processing includes three distinct but correlated latent factors, namely PA, RAN, and PWM (Wagner & Torgesen, 1987), presented visually in *Figure* 2-1, on the next page. PA refers to the ability to pay attention to and manipulate the different sounds and sound combinations of one's language (Anthony & Lonigan, 2004). RAN, also called naming speed, refers to a reader's ability to name out loud presented stimuli in the form of colours, objects, numbers or letters as fast and as accurately as possible (Hulme & Snowling, 2013; Norton & Wolf, 2012). PWM refers to the ability to hold phonological information in working memory (Gathercole & Baddeley, 1993). These phonological processing skills are implicated in different aspects of literacy development, and are relatively stable across development in the absence of intervention (Anthony et al., 2003).

In the sections which follow, I define these constructs as used in the present study and I also address how these constructs develop over time and influence different aspects of literacy. I, then, address how the phonological processing skills are related to one another. I discuss other conceptualisations of RAN, including the Double Deficit Hypothesis, in section 2.5, and I review cross-language transfer of phonological processing skills in section 2.6.

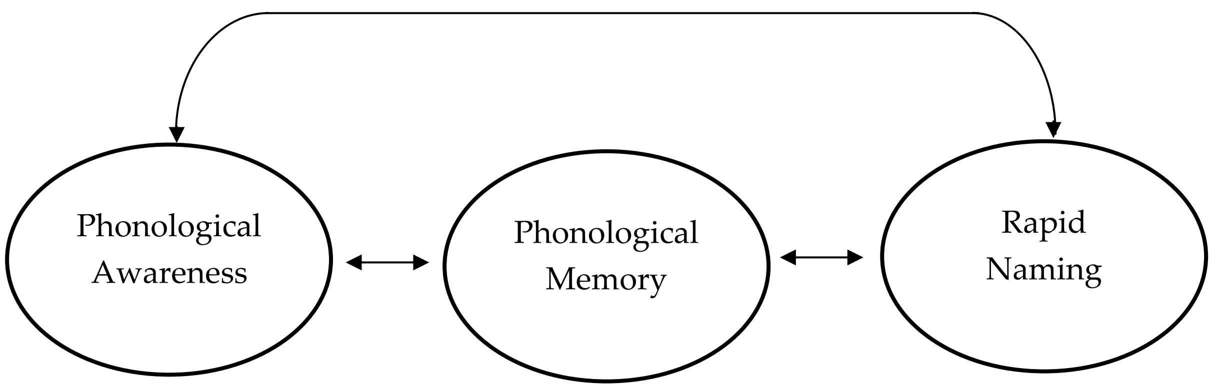

Figure 2-1. Phonological processing model proposed by Wagner and Torgesen (1987)

Notes: Figure adapted from Wagner et al. (2013).

2.4.1 Phonological awareness

2.4.1.1 Phonological awareness and its development via oral language

PA refers to the ability to pay attention to and manipulate the different sounds and sound combinations of one's language, and is implicated in the development of code-related literacy skills such as alphabet knowledge, decoding and word recognition (Wagner & Torgesen, 1987). PA is a single cognitive ability which comprises two dimensions: sound unit size and task complexity (Anthony et al., 2003; Anthony & Francis, 2005). With reference to sound units, PA includes awareness to large units such as words (e.g., *football* is made up of the words *foot* and *ball*), syllables (e.g., *butter* is made up of two syllables: *but-ter*), and rimes (e.g., *cat* and *rat* have the rime, *-at*), as well as small units, such as onsets (e.g., *blink* starts with *bl*), and phonemes (e.g., *cat* has three phonemes, *c-a-t*). All these forms of awareness are subsumed under the umbrella term PA, with awareness of each sound unit being labelled to reflect more specific forms of PA (e.g., the awareness of phonemes is called phoneme awareness) (Adams, 1990; Anthony et al., 2003). PA is also termed phonological sensitivity, reflecting the trend that children move from an implicit sensitivity to large sound units, to more conscious awareness of smaller sound units with exposure to literacy instruction (Anthony et al., 2003). That is not to say that awareness of larger sound units needs to be mastered before awareness of smaller units; rather, children can develop awareness of different sized sound units concurrently, and the development of awareness at one level overlaps with the development of awareness at the next level (Anthony et al., 2003; Anthony & Francis, 2005).

With reference to task complexity, PA varies in the complexity of the operation or task to be performed on the sound units. For example, children can identify that there is a difference between words (e.g., *dot* and *bot* start with different sounds), before they can identify exactly what the difference is. Thus, implicit awareness of sounds develops before explicit awareness and the ability to manipulate sounds. Implicit awareness includes being able to say that two words start the same or not (e.g., do *tap* and *table* start with the same sound?), and explicit awareness includes the ability to segment (e.g., *cat* is made up of *c-a-t*), and delete (e.g., *play* without *l* is *pay*) sound units (Anthony et al., 2003). At the level of manipulation of sound units, the ability to blend sounds arises before the ability to segment sounds (Anthony & Francis, 2005). The manipulation of linguistic units is constrained by working memory (Landerl et al., 2022), which is why some tasks can only be conducted once children are older.

Thus, PA develops along a continuum of linguistic unit and task complexity, and not in a stage-like manner (Anthony et al., 2003). PA can, therefore, be measured in different ways, according to task type and sound units, but all these tasks form part of one PA factor (Anthony & Francis, 2005). The development of PA can be influenced by aspects of the L1, aspects of the orthography, and, for additional language speakers, by aspects of the additional language. Below I explain how oral language influences the development of PA. In section 2.4.1.2, I explain how PA is reciprocally related to literacy and is affected by orthography. I address bilingual PA in section 2.6.1.

2.4.1.1.1 The influence of oral language on phonological awareness development

Even before the start of literacy instruction, characteristics of the spoken language (such as syllable structure, and morpho-phonological processes) affect the rate of development of PA and ultimate proficiency level reached at each linguistic unit level (Anthony & Francis, 2005). Children who speak languages with open (consonant-vowel) syllables (such as Turkish) develop syllable awareness faster than children who speak languages with less salient syllables (such as English). Durgunoğlu and Öney (1999) compared the syllable and phoneme awareness of Turkish and American-English speaking monolingual children in kindergarten and first grade. They found that the Turkish speaking children performed better on syllable awareness tasks in both grades compared to the English speakers, because syllables are salient in Turkish. The Turkish speaking children were also much better at final phoneme deletion in each grade compared to the English-speaking children. The authors explain this difference with reference to the morphology of Turkish where word final consonants are often manipulated when words are inflected. Thus, kindergarten and first grade children were experienced in manipulating phonemes at this position in the word. There is similar evidence from isiXhosa that morphology affects PA development. In a study of 31 grade four isiXhosa speaking children who completed syllable and phoneme awareness tasks, Diemer et al. (2015) found that children performed better on final syllable substitution, and phoneme substitution in the final syllable than on initial syllable/phoneme substitution. Like Durgunoğlu and Öney (1999) they suggest this finding is related to the morphology of isiXhosa words where word final syllables are often manipulated during inflection.

At a more fundamental level, the lexical restructuring hypothesis proposes that oral language skills play a large role in PA development. The lexical restructuring model (Metsala & Walley, 1998) specifies that children's vocabulary growth helps them to develop more fine-grained (or segmental) phonological representations of words. As vocabulary increases, and children are exposed to more words that are minimally different, they can develop awareness of the phonemic level of words. For example, through learning words such as *bat, rat, cat, sat*, children develop awareness of the phonemes at the start of these words that make them different from one another. Thus, vocabulary is an important precursor of PA development, and bilingual children have the opportunity to develop finer representations in more than one language (Krenca et al., 2022).

2.4.1.2 How phonological awareness supports and is supported by literacy

PA supports learning how to read in alphabets because it contributes to the development of letter-sound correspondence knowledge, decoding and text reading skills (Landerl et al., 2022). Indeed, an association between various levels of PA and reading has also been found for languages written in other writing systems, such as the morpho-syllabary of Chinese (Song et al., 2016) and Japanese Kanji (Inoue et al., 2017), the Korean Hangul (which privileges the body and coda) (Cho & McBride-Chang, 2005), the abjad used for Arabic (Tibi & Kirby, 2018), and the alphasyllabary of Sinhala (Wijaythilake et al., 2019). Different levels of PA are associated with literacy in different writing systems. For example, phoneme awareness is associated with reading ability in alphabets (e.g., English: Caravolas et al., 2012; Northern Sotho: Makaure, 2021; Wilsenach, 2019); and syllable awareness is associated with alphasyllabary reading (Nakamura et al., 2018; Wijaythilake et al., 2019). PA is also important for spelling as it is used in parsing the sounds in words, which are then represented by letters in spelling (Caravolas et al., 2012)

Various meta-analyses have reported that PA has a moderate correlation with various reading measures concurrently (r ranges from .29 - .57; Melby-Lervåg et al., 2012; Míguez-Álvarez et al., 2022; Pfost, 2015; Swanson et al., 2003) and longitudinally (r = .43; Hjetland et al., 2020). PA remains a significant unique predictor of reading and spelling after controlling for other phonological processing skills (Caravolas et al., 2012; Makaure, 2021). A lack of PA is also associated with reading failure (Melby-Lervåg et al., 2012). There is a lack of agreement on the extent to which the PA-literacy relationship is affected by orthographic depth. Some research has demonstrated that PA is more relevant for reading in inconsistent than consistent orthographies (Landerl et al., 2019; Ziegler et al., 2010), but other research finds no such difference in the relevance of PA for reading (Caravolas et al., 2012; Moll et al., 2014). The strength of the relationship between PA and reading also tends to decrease with reading experience as children master code-related skills (Vaessen et al., 2010).

As much as PA supports literacy, literacy instruction supports the development of phonological (specifically phoneme) awareness i.e., PA and literacy experience are reciprocally related (Hulme & Snowling, 2013). For example, children learning to read Cantonese Chinese develop phoneme awareness faster when they are taught Pinyin (a roman alphabet version of Chinese taught in early grades) as part of their formal instruction, compared to when they are not (and little attention is paid to phonemes) (Cheung & Chen, 2004). In Tanzania, knowledge of letters was associated with higher levels of PA in Kiswahili (Alcock et al., 2010). Another example of the role of literacy experience on PA is that readers will say that *pitch* [pɪtʃ] has more sounds than *rich* [ɹɪtʃ] because of how these words are spelled even though both words have three phonemes and differ only in the first consonant (Ehri, 2020).

In terms of teaching, phonemic awareness training leads to benefits for both phonemic awareness and reading (Suggate, 2016). At an implicit level, learning to read in a consistent alphabetic orthography is argued to support faster development of phoneme awareness because the consistent letter-sound correspondences reinforce phoneme awareness (Ziegler & Goswami, 2005). On the other hand, phoneme awareness takes longer to develop in an inconsistent orthography, and remains a predictor of reading for longer in development (Ziegler & Goswami, 2005). Evidence from South Africa for Northern Sotho readers shows that phoneme awareness is unlikely to develop in a consistent orthography without explicit and systematic phonics instruction. Wilsenach (2019), for example, found that children were still developing phoneme awareness by the end of the third grade, even though Northern Sotho is written very consistently.

2.4.2 Rapid automatized naming

RAN , also called naming speed, refers to a reader's ability to name out loud presented stimuli (colours, objects, numbers or letters) as fast and as accurately as possible (Hulme & Snowling, 2013; Norton & Wolf, 2012). RAN is correlated with reading fluency across languages and writing systems (Landerl et al., 2022), and is a skill which differentiates dyslexic from normal readers (Norton & Wolf, 2012; Wolf & Bowers, 2000). RAN first appeared as a task correlated with reading performance (Denckla & Rudel, 1976a), and, later, theories were developed to explain how and why this skill is related to reading. In this section, I first address the measurement of RAN, how it develops over time, and discuss how it is related to literacy skills. A discussion of theories of how RAN is related to reading is presented in section 2.5.

2.4.2.1 Measuring naming speed

Examination of naming speed began with the work of Geschwind (1965, 1972 as cited in Wolf (1991)) who first documented the link between reading and the ability to name colours. This work was built on by Denckla and Rudel (1976) who developed what is now known as serial rapid naming tasks where participants read out loud a set of five serially presented stimuli which are randomly sequenced in a set of 50 items. The stimuli came from four categories: colours (red, black, yellow, green, blue), objects (umbrella, key, watch, comb, scissors), letters (a, o, p, d, s) and numbers (2, 4, 6, 7, 9) (Denckla & Rudel, 1976b). Participants are conventionally presented with practice trials before being asked to name the stimuli as fast as possible. In rapid serial naming tasks, participants are timed from when they start and the time is stopped when they name the last item (Denckla & Rudel, 1976b). Either the total time taken to name all items is used as the dependent variable (which will have a negative correlation with reading), or the total number of items scored is divided by the total amount of time taken for the task to produce an items per second score (which will have a positive correlation with reading). The CTOPP is a well-known test which makes use of serial naming tasks (Wagner et al., 2013a).

2.4.2.2 The longitudinal development of RAN

The ability to name non-alphanumeric items (such as colours and objects) develops before the ability to name alphanumeric items (such as letters and numbers) (Norton & Wolf, 2012). This is because alphanumeric RAN requires formal instruction in numbers and letters to make the correspondence between written numbers and letters and their phonological representation. Additionally, bilingual children schooled only in one language, may know alphanumeric items only in the language of schooling (Gottardo et al., 2021). On the other hand, as long as children have familiarity with line drawings and colours, they are able to identify non-alphanumeric items. Thus, non-alphanumeric tasks are often used with children before they enter school. Once children have received formal instruction and have cemented their knowledge of letters and numbers and their recognition is automatic, alphanumeric tasks are completed faster than non-alphanumeric tasks (Åvall et al., 2019; Vaessen & Blomert, 2010). Non-alphanumeric tasks are completed more slowly because the semantic network is activated, and within alphanumeric tasks, digit naming speed is faster than letter naming speed until about age 10 because digits are often learned before letters (Åvall et al., 2019). These trends are presented clearly by Vaessen and Blomert (2010) who explored RAN in samples of grade 1 to grade 6 children in the Netherlands. The mean object naming speed for grade 5 matched the mean digit naming speed for grade 1, clearly demonstrating the difference in latency for the different tasks. Overall, the length of time taken to name both non-alphanumeric and alphanumeric items decreases over the course of development (i.e. children become more automatic, and thus faster, over time) (Åvall et al., 2019; Outón & Ferraces, 2021). Studies on bilingual RAN are lacking so it is not clear whether these patterns also apply to bilingual samples. There is some evidence that language exposure affects whether naming speed improves over time for non-alphanumeric categories. For example, while L1 object naming times did not improve from the start to end of grade 2 for a group of Northern Sotho-English bilinguals who used English as MOI, naming speed improved for a similar group of children who used Northern-Sotho as MOI (Makaure, 2021).

Lastly, research shows that naming speed is a stable construct (Landerl et al., 2019). While children will, on average, improve in their naming speed over time as they develop, their relative performance compared to peers will remain the same (Åvall et al., 2019; Norton & Wolf, 2012). For example, Ozernov-Palchik et al. (2017)

found complete group stability for reading profiles of children when they were in kindergarten into grade 1. Children who were classified as having a RAN deficit remained in this RAN deficit group one year later (i.e., their scores were still behind their peers, even though overall naming speed improved). Similarly, Åvall et al. (2019) found that children with very slow naming speed at four years old, remained slow relative to their peers, although the gap decreased somewhat over time.

Research on how to support the development of RAN is not clear-cut. Vander Stappen and Van Reybroeck (2018) found that an object speed naming intervention improved both object naming speed and reading fluency compared to a group which received PA intervention in French in second grade. On the other hand, letter naming interventions did not improve letter naming in Dutch (De Jong & Vrielink, 2004) nor English (Fugate, 1997) in first grade. These studies are all limited by their small sample sizes (fewer than 50 participants), so it is not clear whether the conflicting findings are due to a lack of an effect, a lack of power or both. Data from longitudinal studies show that the RAN-reading relationship is predominantly unidirectional: RAN affects later literacy, but not vice versa (Inoue et al., 2020; Landerl et al., 2019). These results are perhaps not surprising, given that RAN is stable longitudinally.

2.4.2.3 How RAN is related to literacy

In the model of phonological processing proposed by Wagner and Torgesen (1987), naming speed indicates the speed at which phonological representations can be retrieved from memory[12]. Thus, RAN correlates with reading and spelling tasks because phonological representations are accessed during reading and spelling. Various meta-analyses report a moderate correlation ($r = .33 - .53$)[13] between RAN and literacy: faster naming times are correlated with better reading and spelling ability (Araújo et al., 2015; McWeeny et al., 2022; Song et al., 2016; Swanson et al., 2003). However, there was significant heterogeneity in these effect sizes which means that different factors influence the strength of the relationship.

The strength of the correlations between RAN and literacy reported in the meta-analyses above is moderated by the type of RAN task, the type of reading task, the orthographic depth, and the writing system with which the language is written, and finally, by the grade. Alphanumeric RAN tasks have a stronger correlation with reading tasks than non-alphanumeric RAN tasks (Araújo et al., 2015; McWeeny et al., 2022). The correlation is stronger for real-word reading than nonword reading (Araújo et al., 2015; McWeeny et al., 2022). RAN also has a stronger correlation with reading fluency than reading accuracy tasks (Araújo et al., 2015; Song et al., 2016) but only

[12] Other views of why RAN is related to reading are presented in section 2.5.

[13] I have reported the correlation with a positive sign. Most research will use raw naming times so a negative correlation would be reported.

once reading has reached automaticity. McWeeny et al. (2022) found no difference in the strength of the correlation for reading accuracy and fluency, which they argue is due to the early readers included in their sample where reading accuracy and fluency are still highly correlated. Because Araújo et al. (2015) included various languages and writing systems, they were able to determine that the RAN – reading relationship was stronger in inconsistent than consistent orthographies, and in non-alphabetic than alphabetic orthographies, suggesting greater involvement of orthographic processing. The influence of grade on the RAN-reading relationship is mixed. Swanson et al. (2003) found grade to be a moderator of the RAN-reading relationship. They found the correlation between RAN and real word reading was stronger in higher than earlier grades. On the other hand, Araújo et al. (2015) and Song et al. (2016) found no significant effect of grade on reading fluency, i.e. RAN had a similar correlation to reading across grades. For reading accuracy, Araújo et al. (2015) found a stronger correlation for beginner rather than intermediate readers. There are also variables which do not affect the strength of the RAN reading relationship. These are number of items in the RAN task, or whether the RAN task is standardized or created by the researcher (Araújo et al., 2015; McWeeny et al., 2022).

Research from South Africa in African languages supports a moderate correlation between RAN and literacy tasks. For a group of Northern Sotho-English emergent bilingual children, RAN letters had a stronger correlation with word reading fluency (r = .39) and text reading fluency (r = .45) than RAN objects (r = .30, r = .36 respectively) in L1 Northern Sotho at the start of the second grade (Makaure, 2021). The strength of these correlations was greater at the end of second grade for RAN letters and word reading fluency (r = .68) and text reading fluency (r = .69), and only slightly higher or the same for RAN objects (r = .35, r = .36 respectively, supporting the findings of Swanson et al., (2003) regarding grade as a moderator. Data from other African languages supports the estimates for the RAN-reading relationship. The correlation between RAN digits and text reading fluency was r = .49 in grade 3 in isiXhosa (Schaefer et al., 2020), and the correlation between RAN digits and reading comprehension was r = .34 (Diemer, 2016). Nghikembua (2020) reported correlations for RAN objects and word reading fluency (r = .43), text reading fluency (r = .44), reading comprehension (r = .38) and spelling (r = .24) in Oshikwanyama in second grade.

Finally, longitudinal studies show that the influence of RAN on reading is predominantly unidirectional, that is, RAN influences reading, but reading does not influence RAN. Landerl et al. (2019) examined the cross-lagged relations between RAN, PA and reading for five languages (English, French, German, Dutch, and Greek). Children were assessed at the start of grade 1, end of grade 1, and end of grade 2. They found that RAN (average of colour and digit naming speed) contributed to later reading for all languages and timepoints except for Dutch (start grade 1 to end grade 1) and Greek (end grade 1 to end grade 2). Reading at the previous timepoint was not related to RAN at the next timepoint. Similar results were also found in Chinese. Georgiou et al. (2020) assessed children on measures of RAN (composite of colour and digit naming speed), reading and mathematics each year from grade 1 to grade 5. They found only a unidirectional relationship between RAN and reading: earlier RAN predicted later reading even after controlling for reading at the earlier time point. Compton (2003) did find a bidirectional relationship between RAN (colours and digits included separately) and reading for first grade English speaking children who were assessed once a month. In their study, Compton (2003) found that growth in RAN was related to growth in real word decoding skills (but not nonword decoding skills) for RAN numbers (but not RAN colours). Growth in RAN numbers was also related to the initial acquisition of real word decoding skills. The author explained that learning to read changes the way alphanumeric symbols are stored in memory. Another explanation could be that children became more automatic in recognizing digits as they were exposed to school instruction. Not finding a reading contribution to RAN in other studies (Georgiou et al., 2020; Landerl et al., 2019) may be due to combining scores for alphanumeric and non-alphanumeric tasks, the later time period, and/or fewer assessment points. It may be that bidirectional relations are specific to certain points in reading development (Peterson et al., 2018).

2.4.3 Phonological working memory

PWM is one component of working memory. According to the multicomponent model of working memory[14] (Baddeley & Hitch, 1974), working memory is composed of three components: the visuo-spatial sketchpad, the central executive, and the phonological loop. Each component plays a different role, but all are constrained by limited capacity. The visuo-spatial sketch pad stores and maintains visual and spatial information in the short term (Baddeley, 2012). The phonological loop stores and maintains phonological information in the short term using (sub)vocal rehearsal (Baddeley, 2012). The phonological loop has limited processing capacity, such that typical adults can recall six or seven digits, or five words in serial order (Baddeley, 2012). However, when words are related semantically, as in a sentence, the system can hold up to 15 words (Baddeley, 2012). The central executive is responsible for focusing attention, dividing attention and task switching, and acts as an episodic buffer which integrates information from the phonological loop and visuospatial sketchpad, as well as with long term memory (Baddeley, 2012). The working memory components are

[14] There are alternative theories of working memory which are not addressed in the present study, as the Baddeley and Hitch (1974) model is more well-known. See Adams et al. (2018) for a review of two additional models known as the modal model, and the embedded processes model.

fluid systems that are temporarily activated, and feed into, and are influenced by more crystallised information in long term memory via the episodic buffer.

In the literature, the central executive is often referred to as working memory, and the phonological loop and visuospatial sketchpad are referred to as short term memory. Often, the terms 'short-term memory' and 'working memory' are used interchangeably, with the former usually referring to only the maintenance of information in short term memory and the latter referring to maintenance and manipulation of information in short term memory (Aben et al., 2012). Strictly speaking, my study will measure short term memory, but because literacy research mostly refers to working memory to refer to the same tasks I use, I use the term PWM in my research.

In this thesis, the phonological loop of working memory, also called PWM, is of relevance. PWM refers to the ability to hold phonological information in working memory (Gathercole & Baddeley, 1993). PWM is measured using nonword repetition (NWR) tasks and digit span tasks. NWR tasks require participants to immediately repeat a previously unheard nonword (Gathercole et al., 1994). For instance, in Northern Soho, an individual will be asked to repeat the nonword *balobadikwe* – this word follows the phonological rules of the target language, and is thus a permissible word that does not exist (Wilsenach, 2016). Answers are scored correct if participants say the entire nonword as it was pronounced, and answers are incorrect if any part of the nonword is repeated incorrectly. Thus, this task assesses memory for items (Demoulin & Kolinsky, 2016). Another PWM task is the digit span task. In this task, a series of digits is presented to the participant with a short pause between each digit. The participant should repeat the digits in the same order they heard them. Again, the answer is only correct if repeated exactly as heard. Thus, this task assesses memory for order (Demoulin & Kolinsky, 2016). Because working memory capacity is limited, performance on these tasks decreases as the number of digits or length of nonwords increases (Gathercole et al., 1994). Long term memory can be recruited in NWR tasks, as well. Nonwords that are more word-like are pronounced correctly more often than nonwords that are less word-like (Gathercole et al., 1994). Thus, performance on NWR tasks can be affected by language experience to more of an extent than digit span tasks (Windsor et al., 2010).

The NWR task in an African language has been successfully used with Northern Sotho (Makaure, 2016, 2021; Wilsenach, 2016), Setswana (Malda et al., 2014), isiZulu and Siswati (Schaefer & Kotzé, 2019), Herero (Veii & Everat, 2005) and Swahili (Alcock et al., 2010) speaking children. With regards to digit span tasks, some researchers (Wilsenach, 2016; Wilsenach & Makaure, 2018) have used only an English digit span task, whereas others have used the African language (Malda et al., 2014), or both languages (Makaure, 2021). In the school context, teachers may prefer to use the English names for numbers. It is therefore important to determine what method of teaching is used before using either the English or African language versions of a digit span task (Makaure, 2021).

2.4.3.1 How working memory develops over time

PWM capacity develops naturally over time, but can be supported by learning to read, vocabulary growth and training. These topics are addressed briefly below. The capacity to store phonological information in the short term increases with age. Gathercole et al. (1994) assessed children of various ages cross-sectionally. The mean raw score on a NWR test was three to four points higher for each year band from four years old to 9 years old. Growth in working memory is not linear. There is steeper growth between kindergarten and first grade, with growth slowing down around grade 2, or age 8 (Gathercole, 1999; Shuai Zhang & Joshi, 2020), and reaching a ceiling at around age 11 or 12 (Gathercole, 1999).

Learning to read in an alphabet also affects the development of PWM, specifically NWR. Learning how to read supports the development of finer phonemic representations of words (see section 2.4.1.2), which then supports the access to and encoding of phonological information, thereby supporting the development of PWM (Cunningham et al., 2021). In their longitudinal study of children from age 4 to 9 years, Cunnginham et al. (2021) found that letter knowledge at age 4 directly predicted NWR at age 5, and word reading at age 6 directly predicted NWR at age 9. Phoneme awareness also mediated the relationship between letter knowledge and NWR from age 4 to 5, to 6. Thus, increased phonemic segmentation of phonological information that is a consequence of reading, and improved PA, also supports the development of NWR, specifically. Vocabulary knowledge and growth also contribute to improvements in NWR via lexical restructuring at early ages. That is, as children learn more words, they are better able to make phonemic distinctions, which positively affects their NWR abilities (Verhagen et al., 2019).

The development of PWM can also be supported by training, but PWM training does not necessarily affect reading. In their meta-analysis of 23 studies, Melby-Lervåg and Hulme (2013) found that verbal working memory training leads to a large effect size gain ($d = .79$) in verbal working memory at post-test points, with larger gains for younger than older children. However, these gains were not maintained to delayed post-tests (about 9 months later) and did not transfer to word reading tasks. The post-test analysis effects on word reading were constrained by a small number of effect sizes (6 and 7, respectively), so when more studies are available, there may be evidence of a significant lasting effect.

2.4.3.2 *How phonological working memory is related to literacy*

PWM is implicated in the initial stages of learning vocabulary, and in the initial stages of learning to read (Baddeley, 2012; Engel de Abreu & Gathercole, 2012) (Baddeley 2012). With regards to vocabulary, new sounds and words are processed through PWM as phonological representations, and eventually stored in long-term memory (Gathercole & Baddeley, 1993). Should the capacity of PWM be low or constrained this affects how accurately or efficiently these new words are retained in long-term memory (Gathercole & Baddeley, 1993; Wilsenach, 2016). A "dynamic interactive relationship" has been found between vocabulary learning and PWM (Gathercole et al., 1994, p. 116). At younger ages (up to age 5), PWM predicts vocabulary, but at later ages (around age 8) vocabulary predicts PWM. As explained, PWM is needed to convert novel phonological representations into words in long-term memory. At later ages, children may use their existing word knowledge to help them repeat novel words in NWR tasks (Gathercole et al. 1994).

With regards to reading, PWM can affect the speed or accuracy of acquisition of letter-sound correspondences needed for successful phonological recoding (Gathercole & Baddeley, 1993). Gathercole and Baddeley (1993) explain that successful recoding relies on the child being able to match the graphemes to the sound segments, hold these in working memory, and to blend these sounds to correctly recognise the word in print. Poor PWM makes it more difficult for children to match phonemes to their graphemes, and to hold the sound segments of a phonologically recoded word in memory. PWM is also used for PA tasks, especially those which are more difficult and require manipulation, such as elision tasks (Anthony et al., 2003).

The correlations between PWM and reading are weak and significant. The meta-analysis by Melby-Lervåg et al. (2012) found a correlation of $r = .34$ between PWM and word reading. There were insufficient studies to determine if the correlation differed between real and nonword reading. Peng et al. (2018) expanded these results in their meta-analysis of 197 studies. They also found a weak and significant meta-correlation of $r = .29$ between PWM and reading. The correlation between PWM and decoding, and PWM and reading comprehension was similar (Peng et al., 2018). For decoding, specifically, PWM had a slightly stronger relation to real word ($r = .29$) than nonword reading ($r = .25$), and a stronger correlation for isolated word reading ($r = .29$) than text reading ($r = .24$). The correlation between PWM and reading was also stronger for children in earlier grades (before grade 4) ($r = .32$) than those in later grades ($r = .27$), reflecting the change in development of PWM, discussed in section 2.4.3.1. Cunningham et al. (2021) found that a latent short-term memory (digit span) variable and a NWR latent variable had direct effects on later reading from ages 5 to 6, with indirect effects through PA at ages 4 to 5 to 6, and 5 to

6 to 9 and not at age 6 or 9. Only the digit span latent variable predicted reading from age 4 to 5.

With regards to reading comprehension, PWM may be indirectly related through its influence on vocabulary and decoding. Peng et al. (2018) used meta-regression to determine if PWM made a unique contribution to reading comprehension after controlling for decoding and vocabulary. When only one of these constructs was controlled, PWM explained unique variance in reading comprehension. However, once both decoding and vocabulary were entered into the meta-regression, PWM no longer made a unique contribution to reading comprehension. The authors explain that this finding supports the view of PWM as having an indirect relation to reading comprehension through both decoding and vocabulary. Cunningham et al. (2021) also found that the effect of PWM on reading was mediated by PA, which is supported by Melby-Lervåg et al. (2012). They found that the partial correlation between PWM and reading became nonsignificant when controlling phoneme and rime awareness.

NWR and digit span tasks are moderately to strongly correlated (r = .40 - .70) with one another within the same language (Engel de Abreu & Gathercole, 2012; Gathercole et al., 1994; Makaure, 2021). One study on predominantly monolingual English children which used latent variable modelling found that NWR and digit span tasks loaded on two separate factors (Cunningham et al., 2021). Thus, while NWR and digit span tasks capture variance in PWM, these tasks do not correlate so highly as to be interchangeable. Given the review above, NWR is more likely to be influenced by language experience and aptitude, compared to digit span tasks.

2.4.4 How the three phonological processing skills are related

Each phonological processing skill has a differential relation to literacy sub-skills as discussed above. Each phonological processing skill can be measured using different tasks, with each task measuring a certain aspect of the construct. All these different sub-skills and sub-tasks make it difficult to isolate the specific effect of each construct on the other. Latent variable modelling is a specific analytical approach which reduces the number of variables in an analysis by grouping tasks that measure the same construct together. Confirmatory factor analysis is used to confirm how indicator (observed) variables are related to latent (unobserved) variables.

The literature reviewed above indicates that PA and PWM are more closely related than RAN is to either. For example, PWM resources are recruited in PA tasks, and PA mediates the relation between PWM and reading. In most cases, PA and RAN remain significant predictors of literacy when controlling for one another, but the role of PWM becomes small and nonsignificant when PA is controlled. Thus, PA and PWM share variance with one another, that is not shared with RAN.

A latent variable model for participants aged 7 to 24 finds that PA and PWM are moderately correlated to one another (r = .67), with weaker relations between RAN and PA (r = .26), and RAN and PWM (r = .26) in English at the latent level (Wagner et al., 2013a). For younger children, Lonigan et al. (2009) found support for this three factor structure, but a two factor structure (with PA and PWM) on the same factor also supported the data and was used as it was more parsimonious. This second finding supports the view that PA and PWM share variance. In summary, all three skills are related to one another, with PA and PWM having the stronger correlation.

2.5 OTHER THEORETICAL CONSIDERATIONS: RAN

In the phonological processing model proposed by Wagner and Torgesen (1987), RAN is one of the three phonological processing skills that indicates the speed of lexical access. However, there is a debate as to whether RAN really does measure speed of lexical access, and, therefore, whether it should be considered a phonological processing skill. In addition to the phonological processing model, other accounts of what RAN measures include the orthographic processing account, general speed of processing account, and the domain general account. In attempting to explain what RAN measures, researchers identify a possible mediator and then include both RAN and the mediator as predictors of the literacy outcome. If the direct influence of RAN is no longer significant, then this is evidence that the mediator explains why RAN is related to reading (Georgiou & Parrila, 2020).

As explained in this chapter, the phonological processing account subsumes RAN as a phonological processing skill which indexes the rate of access to and retrieval of phonological information from long-term memory (Kirby et al., 2010; Wagner & Torgesen, 1987). Proponents of this view suggest that RAN taps phonological processes in that visual stimuli must be converted to phonological codes (Logan et al., 2011). Data to support this account comes from Wagner et al. (1993) who found that after measuring the three phonological processing skills (PA, phonological memory and lexical access) in Kindergarten and grade 2 children, and using confirmatory factor analysis, the model with the best fit was the one where these three skills were specified as distinct but interrelated. Data from the RAN-mathematics relationship also supports the idea that RAN is related to reading/mathematics because it indexes the speed with which phonological information is processed. Koponen et al. (2017) reported a stronger meta-analytic correlation between RAN and arithmetic fluency (which relies on rapid access to phonological information) than general mathematics ability (which relies more on other sub-skills). This phonological processing view of RAN predicts that all three phonological processing skills will be significantly correlated but can still account for significant variance in the outcome variable after controlling PA and PWM.

The double deficit account of RAN argues that RAN is a separate sub-skill from phonological processing (Wolf & Bowers, 1999). Wolf and Bowers (1999) argue that RAN should not be considered a phonological processing skill as it relies on very different underlying components. RAN tasks can be seen to "represent a microcosm of reading" (Wolf & Bowers, 1999, p. 418). Both RAN and reading require serial visual processing of print symbols from left to right, accessing of the phonological representation of the symbol, automatic integration across these components, and articulation (Kirby et al., 2010; Norton & Wolf, 2012). RAN and reading do, however, differ in that reading requires the reader to pay attention to meaning, whereas RAN tasks do not, and reading is often completed silently while RAN tasks are oral (Kirby et al., 2010). Wolf and Bowers (1999) also appeal to two more trends to support their view that RAN is not primarily phonological. Firstly, RAN has modest correlations with PA and PWM. Secondly, RAN has specific and different interrelationships with reading skills compared to PA, suggesting that PA and RAN do not share a lot in common, i.e., are partially independent. It has been repeatedly found that RAN is more related to reading fluency, and PA to decoding and reading accuracy. The relation of PA to reading changes with reading development, whereas the involvement of RAN is stable across the grades. These relationships were addressed in detail in sections 2.4.1.2 and 2.4.2.3. Wolf and Bowers (1999) also argue that RAN should be a separate factor from phonological processing as reading disabled children with a RAN deficit or double deficit (PA and RAN deficit) have different strengths and weaknesses compared to children who have a PA deficit only.

Those who do not see RAN as primarily a phonological processing task, have offered other explanations. Some researchers suggest that RAN indexes (speed of) orthographic processing. For example, Bowers and Wolf (1993) hypothesized that RAN reflects how fast readers can learn orthography-phonology correspondences from print exposure. From this view, slow naming speed affects orthographic awareness as it slows the amalgamation of orthography-phonology relations at the sub-lexical and lexical levels, thereby affecting the quality of orthographic representations, which necessitates the need for more exposures before high quality learning takes place. Manis et al. (1999) extend this view by specifying that RAN is related to reading because it indexes the ability to make arbitrary orthography-phonology correspondences (e.g., digit names are arbitrarily related to the symbols). From this view, RAN should be more important for real word than nonword reading (especially in inconsistently written languages) (Manis et al., 1999).

Earlier accounts of the RAN-reading relationship explain that RAN reflects general speed of processing (Kail et al., 1999; Kail & Hall, 1994). Kail and Hall (1994) used structural equation modelling to determine whether naming speed was predicted by age (reflecting general improvement in the automaticity of retrieving codes) or processing speed (reflecting general cognitive constraints on processing speed). They found that RAN was predicted by processing speed and not age. More recent accounts of RAN (e.g., domain general accounts) suggest that naming speed is related to reading because it shares many aspects with oral reading such as serial processing and articulation (Georgiou et al., 2013). In their study of grade 2 and grade 6 Greek readers, Georgiou et al. (2013) compared the unique effect of different RAN tasks for reading based on different aspects of RAN at the input stage (serial vs discrete naming), processing stage (small vs large set size) and output stage (articulation or not). They found that only serial naming, and naming tasks which required articulation were significant predictors of reading, suggesting that RAN is related to reading because of shared serial processing and articulation requirements. Georgiou and Parrila (2020) replicated the 2013 study with a group of grade 2 and University level English readers. They replicated the findings of Georgiou et al. (2013) but found an influence of set size for the grade 2 readers only, reflecting that naming speed is also affected by retrieval of phonological codes at early stages of reading development. Thus, Georgiou and Parrila (2020) conclude that RAN is related to reading not only because of articulation and serial processing, but also via phonological processing at early stages of reading development.

Martinez et al. (2021) tested all these accounts of the RAN-reading relationship using data from third grade Spanish readers. They measured RAN digits, RAN objects, lexical and sublexical orthographic knowledge, phonemic awareness, speed of processing, multielement processing and oral reading fluency. Using parallel multiple mediator path analysis, they included direct paths from RAN to reading fluency as well as an indirect path via phonemic awareness/speed of processing/multi element processing to orthographic knowledge to reading fluency, and an indirect path via orthographic knowledge only. They found that RAN was related to reading fluency directly, and indirectly in three ways: (1) via orthographic knowledge, (2) via the indirect effect on phonemic awareness on reading fluency, and (3) via the indirect effect of phonemic awareness on orthographic knowledge then on reading fluency. RAN predicted speed of processing, but speed of processing was not related to other outcome variables. This study showed that the RAN-reading relationship is not fully explained by the orthographic processing, phonological processing, or speed of processing accounts, as RAN continued to have a direct effect on reading fluency.

In summary, while there are three major accounts (phonological, orthographic, speed of processing) which attempt to explain the RAN-reading fluency, recent evidence has found that the data do not fully support either account. Rather, the RAN-reading relationship is multi-componential and can be understood as sharing variance through factors similar to both RAN and reading: access of arbitrary symbol-sound relations, serial processing of visual stimuli, and articulatory demands from oral naming/reading. Phonological access, orthographic processing and speed of processing underlies these processes but do not account for all the variance (Papadopoulos et al., 2016). I have not set up my study to test whether RAN should be considered as part of the phonological processing model or not, and this is not a primary aim of my study. Rather, these other considerations are presented as they offer alternative interpretations of why RAN is related to reading.

2.6 CROSS LANGUAGE TRANSFER OF PHONOLOGICAL PROCESSING SKILLS

As mentioned earlier in this chapter, phonological processing skills are utilized for both L1 and L2 reading and spelling. According to the Linguistic Interdependence Hypothesis (Cummins, 1979), L1 skills can transfer to L2 when there is sufficient instruction in L2 and motivation to learn it. The script dependent hypothesis and the central processing hypothesis are complementary hypotheses which suggest that the development of and use of certain cognitive-linguistic skills will be script dependent, but that the same abilities will underlie reading and spelling (Geva & Siegel, 2000). The task of the bilingual/biliterate reader is to discover how orthography is mapped to phonology in the additional language, and to use existing phonological processing skills and develop finer grained representations when needed. In this section, I review research on how PA, RAN and PWM are related to one another within the same construct for bilinguals. Large correlations are indicative of cross-language transfer within these constructs. I also present research on how these constructs are related to literacy across-language. An examination of these correlations can provide some evidence about whether phonological processing skills are language general (and based on an underlying ability) or language/orthography specific.

2.6.1 Bilingual PA and its relation to literacy

2.6.1.1 How L1 and L2 PA are related to each other

PA is a metalinguistic skill and is part of the code-related skills related to reading. As such, PA skills developed in one language have a moderate to strong correlation with PA in the other language. In a meta-analysis of 16 independent correlations, Melby-Lervåg and Lervåg (2011) reported a moderate to strong corrected correlation in the range of .57 - .62 between L1 and L2 PA. There was heterogeneity in the correlations suggesting an influence of moderating variables (e.g., instructional language, age), but none reached significance. Branum-Martin et al. (2012) expanded on this initial meta-analysis by including more studies and specifying correlations between various tasks of PA in each language. All included studies presented correlations between English and another language. In most cases, English was the additional language. They were able to collect 101 correlations from 38 studies. The findings of Branum-Martin et al. (2012) were similar to those of the previous meta-analysis: PA in L1 and L2 were moderately to strongly correlated (r = .39 - .86), with stronger correlations between alphabetically written languages, than with Cantonese and Mandarin; and correlations were smaller for older compared to younger children. The model indicated variability not explained by the model, which the authors suggest could be due to student or instructional factors not reported.

This moderate to strong correlation between L1 and L2 PA has led researchers such as Branum-Martin et al. (2015) to question whether PA is a language general construct, or a language specific construct. Specifically, Branum-Martin et al. (2015) consider whether PA correlates in two languages because the same tasks are used in each language (i.e. there is shared method variance), or because PA is a single construct. On the one hand, if PA is language general, then instruction in either language should lead to reading gains in either language. However, if PA is language specific, then specific intervention needs to be conducted in each language. These two views were tested by fitting competing confirmatory factor analysis models to the correlation matrices for studies reported in Branum-Martin et al. (2012). A language specific model included a latent variable for each language while a language general model included one latent variable from which indicators in both languages arose (*Figure* 2-2).

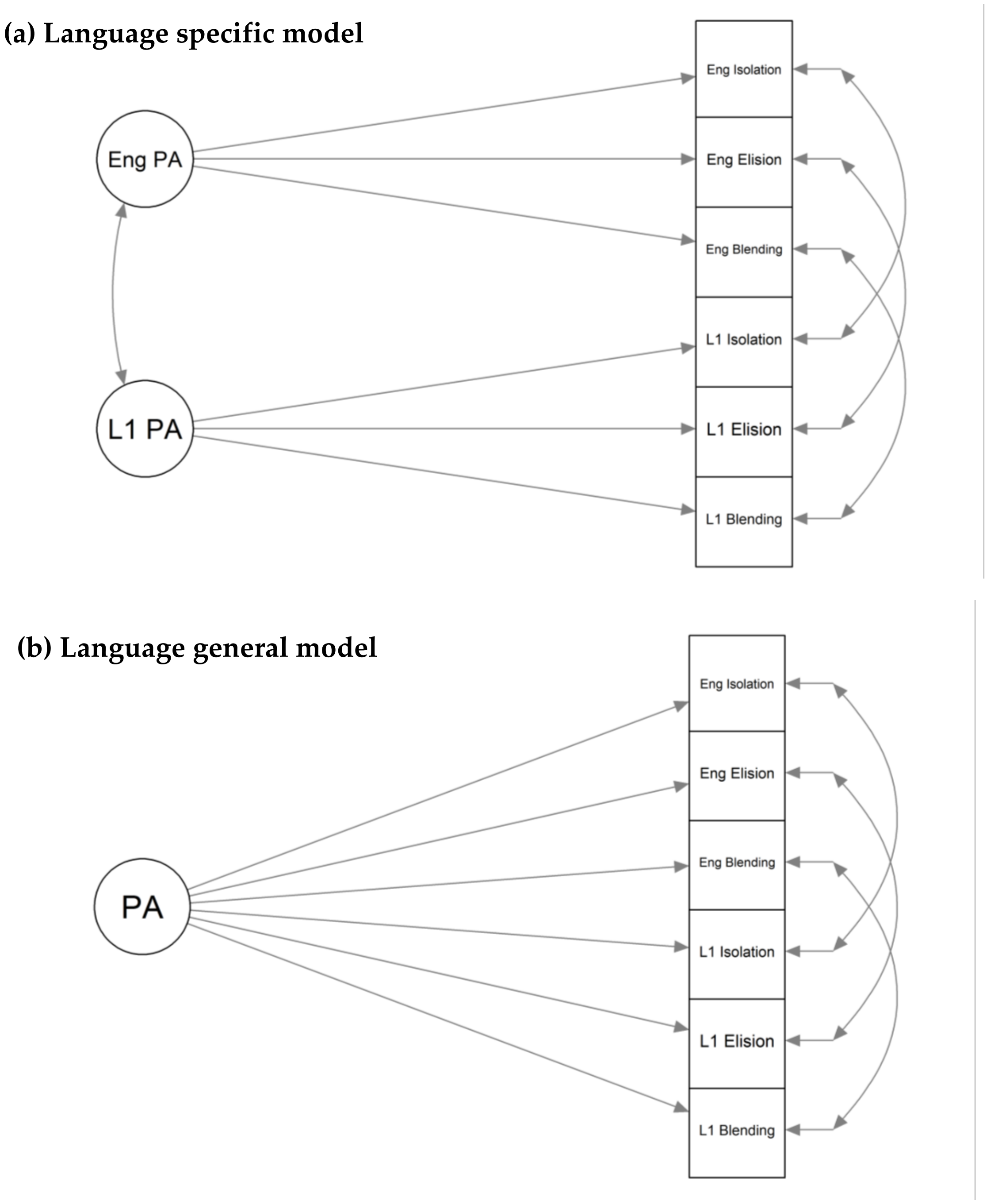

Figure 2-2. Language specific (a) and language general (b) models of phonological awareness

Within each model, Branum-Martin et al. (2015) allowed the residuals of shared tasks to correlate (i.e. English elision correlated with Spanish elision). They found that for most studies, a two-factor model fit best (i.e., a latent variable for PA in each language) with large correlations ranging from .66 - .98 between latent variables. Fewer studies had good fit with a one factor model. The correlations between PA in Spanish and English was also reported to be higher than previous metanalyses because the confirmatory factor analysis allows the residuals of similar tasks to be correlated (i.e., accounts for method variance; Maul, 2013). Thus, CFA accounts for measurement error allowing a more accurate estimation of the within-language and across-language correlations (In'nami et al., 2021). A review of PA in other language pairs supports the finding that the PA of bilingual speakers in different languages is strongly correlated, but does not completely overlap (Gottardo et al., 2021). Saiegh-Haddad (2019) suggests that L1 PA and L2 PA overlap in so far as both require meta-linguistic awareness that words can be broken down into sounds. However, Saiegh-Haddad (2019) argues that some aspect of L2 PA is language specific, and affected by the quality of phonological representations in L2. The quality of phonological representations is influenced by L2 proficiency and how different the L1 and L2 are in sound structure.

In summary, PA is a language specific construct with large correlations in L1 and L2 for alphabetically written languages. This finding supports the idea that PA develops specifically in each language based on the language characteristics and orthography, but is highly related, with skills in one language supporting skills in the other. Thus, instruction in one language may benefit the development of PA in the other language, but there may be some language specific PA considerations related to language structure, orthography, and language proficiency.

2.6.1.2 How L1 PA and L2 PA are related to L2 and L1 reading

Owing to the moderate to strong correlation between L1 and L2 PA, and the moderate to strong correlation between L1 and L2 decoding, it is no surprise that L1 PA and L2 decoding are moderately correlated (adjusted overall correlation: $r = .5$) (Melby-Lervåg & Lervåg, 2011). Melby-Lervåg and Lervåg (2011) did not find significant moderators even though there was large variation in the correlations across studies. Evidence from primary studies indicates that L2 oral language proficiency, language of instruction, and or/overall reading ability in L1 and L2 may affect the strength of the correlation between L1 PA and L2 reading. It is important to not only consider the correlation between variables, but also their means. For example, in some contexts such as South Africa, there is reduced variation in English reading scores as many children read very slowly, thus, correlations can be expected to be lower between L1 PA and L2 English reading.

For example, Gottardo et al. (2016) found weak to moderate correlations ($r = .31$ - $.54$) between L1 PA and English reading in Spanish sequential bilinguals, and Portuguese simultaneous bilinguals in first grade who received English instruction. In South Africa, correlations of similar strength were found for a group of Northern Sotho-English sequential bilinguals in an English medium school, but were weaker for a Northern Sotho-English bilingual group in a Northern Sotho medium of instruction school ($r = .09$ - $.38$) (Makaure, 2021). This may be due to reduced variation in English reading scores which would flatten out the correlations or may be due to more reliance on L1 PA since most of their instruction was in this language.

L2 PA to L1 decoding correlations were weaker (r = .10 - .22) in the study by Gottardo et al. (2016), and in regression analyses only L1 PA made significant contributions to L1 decoding after including English PA in the models. Gottardo et al. (2016) argue that language specific PA is used to read in each script, thus providing evidence for the script dependent hypothesis (Geva & Siegel, 2000). Stronger correlations (r = .30 - .69) of L2 PA on L1 reading were found in South Africa for Northern Sotho-English sequential bilinguals attending English medium of instruction schools and the correlations did not seem to be affected by medium of instruction (Makaure, 2021). Thus, the strength of the PA-reading correlation varies by context, and is affected by the script that children are reading in.

2.6.2 Bilingual RAN and its relation to literacy

I address cross-language correlations of L1 RAN – L2 RAN, L1 RAN – L2 reading, and L2 RAN – L1 RAN in one section as naming speed reflects the same underlying components also used in reading, independent of the language of assessment, if items are *automatically* recognized. For bilinguals, some items are known better in one language than another, depending on language exposure and instruction, and in some contexts can only be measured in one language (Gottardo et al., 2021). For example, Makaure (2021) found that children knew numbers only in English, and not in Northern Sotho, reflecting instructional practices in South Africa, where numbers are taught in English even in L1 medium schools. Even if RAN tasks are administered in both languages, there may be differences in total time that reflect language exposure or instruction rather than naming speed per se. Gottardo (2002) found that children were slower to name objects and digits in their L1 Spanish than English on the same tasks reflecting the English medium instruction they received at school. Likewise, at university level, Georgiou et al. (2022) found that participants were faster in L1 than L2 RAN, except for those who were schooled predominantly in English (and had faster English than L1 RAN).

The correlation between RAN tasks in different languages may be lower if students are not instructed in both languages, and higher if students can automatically recognise the items in both language (Gottardo et al., 2021). Makaure (2021) reported weak to moderate correlations (r = .20 - .46) between L1 and English RAN tasks for Northern-Sotho -English emergent bilinguals attending an English MOI school, but weak correlations (r = .08 - .31) for children attending a Northern Sotho MOI school in grade 2. For university students highly proficient in L1 and English, correlations ranged from weak (Spanish-English: r = .36) to strong (Japanese-English: r = .76) between L1 and L2 RAN scores (Georgiou et al., 2022).

With regards to the RAN-reading relationship across languages, the study by Georgiou et al. (2022) showed that the variance in reading fluency explained by RAN in L1 and L2 overlaps. That is, in a regression, L2 RAN did not explain additional variance in L2 reading when controlling for L1 RAN, and in a second model, L1 RAN did not explain additional variance in L2 reading fluency when controlling for L2 RAN. The authors concluded that RAN represents a common underlying skill (Georgiou et al., 2022), in accordance with the central processing hypothesis. Thus, once RAN and reading are automated, RAN reflects a language general construct. In the study of Georgiou et al. (2022), RAN digits measured in either language had strong correlations with reading fluency, and was conducted with adults who were fluent in two languages. For emergent bilingual children it may not be possible to measure RAN in both languages. Thus, this data supports the suggestion of Gottardo et al. (2021) that it is sufficient to measure RAN in the language the child knows best.

In summary, RAN appears to be a language general construct which can be measured in multiple languages, for bilinguals. However, RAN scores, especially for non-alphanumeric items, are affected by language familiarity and instruction.

2.6.3 Bilingual PWM and its relation to literacy

PWM is measured using NWR tasks and digit span tasks in the CTOPP (Wagner et al., 2013a). Cross-language correlations between PWM tasks range from weak to moderate (r = .20 - .50). For example, in a foreign language learning context, Masoura and Gathercole (1999) reported a moderate (r = .48) correlation between NWR in L1 Greek and English foreign language for children. A correlation of similar size (r = .51) was found for adult Korean-English students on a six-syllable NWR task, with nonsignificant very weak correlations for the simpler two and four syllable tasks. In South Africa, Makaure (2021) also found weak to moderate cross-language correlations for NWR and digit span tasks at the start of grade 2 (English MOI: r = .24 - .42; L1 MOI: r = .21 - .51) and at the end of grade 2 (English MOI: r = .37 - .57; L1 MOI: r = .46 - .75).

Regarding reading, across-language PWM-reading correlations are weaker than within-language PWM-reading correlations. There is a significant weak correlation between L1 PWM and L2 reading comprehension. In their meta-analysis, In'nami et al. (2021) reported a meta-correlation of r = .30 based on 74 studies. The strength of this relationship was not moderated by type of working memory task, but the L1 PWM – L2 reading comprehension (cross-language) correlation (r = .20) was smaller than the L2 PWM – L2 reading comprehension (within-language) correlation (r = .37) (In'nami et al., 2021). This finding supports that of Shin (2020) who also found stronger within (r = .35) than cross-language (r = .17) correlations between working memory and reading comprehension. In'nami et al. (2021) suggest that the L1 PWM tasks conflate PWM and language proficiency in L2, and caution against the use of averaging L1 and L2 PWM scores for correlational analysis. As reviewed above, NWR are also affected by language exposure. Thus, PWM scores may be affected by language exposure, but are moderately related in L1 and L2.

2.7 PHONOLOGICAL PROCESSING AND LITERACY IN AFRICAN LANGUAGE – ENGLISH EMERGENT BILINGUALS

I have referred to research from Africa where relevant throughout the review, and now briefly summarise the relevant information for this study according to cross-sectional research (section 2.7.1) and longitudinal research (2.7.2). I then explicitly identify the research gap that I address.

The orthographic conventions differ for the Nguni and Sotho language groups in South Africa, based on both the influence of missionaries, and because of morpho-phonological processes in each language. Nguni languages (isiNdebele, isiXhosa, isiZulu, and Siswati) are written conjunctively. Sotho language (Setswana, Southern Sotho, and Northern Sotho) are written disjunctively. Xitsonga and Tshivenda lie somewhat in the middle of this continuum. Nevertheless, these languages are all written consistently in that the letters consistently correspond to the same sounds and vice versa, and the languages have predominantly open syllables. Section 3.6 provides more detail about the structures of isiXhosa and isiZulu.

2.7.1 Cross-sectional findings of within and between language relations for phonological processing, vocabulary, and literacy of African language – English bilinguals

Research on how phonological processing skills and vocabulary are related to literacy in African languages has been growing over the last two decades. The most researched languages are **isiZulu** (de Sousa et al., 2010; Land, 2015b, 2015a, 2016; Schaefer & Kotzé, 2019) and **isiXhosa** (Daries, 2021; Daries & Probert, 2020; Diemer et al., 2015; Schaefer et al., 2020), with the least research in **Siswati** (Schaefer & Kotzé, 2019) and **isiNdebele** (Sithole, 2018). For the Sotho group, **Northern Sotho** has received the most attention (Makaure, 2016, 2021; Wilsenach, 2013, 2015, 2016, 2019; Wilsenach & Makaure, 2018), with a few studies on **Setswana** (Lekgoko & Winskel, 2008; Malda et al., 2014; Probert, 2019). **Xitsonga** has been examined by Khosa (2021). Some studies, such as those by Ardington et al. (2021) and Spaull et al. (2020) examine only literacy outcomes without relating them to phonological processing skills, and some studies relate vocabulary skills to literacy outcomes (Wilsenach, 2015; Wilsenach & Schaefer, 2022). Importantly, many of these studies do not include data on both languages that the child knows.

With regards to PA, the findings support what has been found for other languages. Children perform much better on syllable awareness tasks than phoneme tasks in isiXhosa (grade 3: Diemer, 2016; grade 4: Diemer et al., 2015) and Northern Sotho (grade 1 and 2: Makaure, 2021; grade 3: Makaure, 2016). PA has a moderate to strong correlation with word reading, text reading and reading comprehension at the end of grade 1 (Xitsonga: Khosa, 2021), end of grade 2 (Northern Sotho: Makaure, 2021), and end of grade 3 (isiXhosa: Schaefer et al., 2020; Northern Sotho: Wilsenach, 2019).

At grade 3 level, PA makes a significant contribution to word reading (but literacy variables were not controlled). For example, L1 PA in Northern Sotho made a significant contribution to Northern Sotho and English word reading in two samples of children (Wilsenach, 2013, 2019). However, PA does not make a significant contribution to fluent text reading once other variables such as word reading (Northern Sotho: Wilsenach, 2019), and morphological awareness and RAN are controlled (isiXhosa: Schaefer et al., 2020). Malda et al. (2014) found a non-significant weak effect of Setswana PA on Setswana fluent reading in grade 3. This is to be expected as PA exerts most influence on early reading development. PA contributes to spelling for third grade isiXhosa readers, even when text reading ability is controlled.

Measures of RAN and PWM are less often included in studies, but the data supports what has been found for other languages. RAN has been found to be a significant predictor of reading fluency in isiXhosa (grade 3: Daries, 2021; Schaefer et al., 2020), and Northern Sotho (grade 2: Makaure, 2021; grade 3: Makaure, 2016). Malda et al. (2014) explored the structural relations among PWM, PA, vocabulary, text reading fluency and reading comprehension in three groups of children who spoke English, Afrikaans, and Setswana. They found that short-term memory had an indirect effect on reading fluency via PA. The relation of vocabulary to reading ability has also been less researched. At third grade level, Malda et al. (2014) found a weak significant direct effect of vocabulary on reading comprehension in Setswana, and Wilsenach and Schaefer (2022) found a moderate correlation between vocabulary in L1 isiZulu/Siswati and reading comprehension in L1 and English.

Few studies have examined the phonological processing and reading variables in both languages the child knows. Makaure is an exception here. She examined the phonological processing and reading abilities of Northern Sotho-English emergent bilinguals in a Northern Sotho MOI school, and an English MOI school at the start and end of grade 2 (Makaure, 2021), and end of grade 3 (Makaure, 2016). Makaure used multiple regression analysis to examine cross-language transfer: English phonological processing variables were used to predict L1 reading variables, and L1 phonological processing variables were used to predict English reading. Her research demonstrates cross-language transfer from L1 PA to English reading, and from L2 PA to L1 reading across the measurement points when controlling the other phonological processing variables. The contributions of PWM and RAN tasks differed by measuring point with no clear developmental pattern.

2.7.2 Longitudinal development of phonological processing, vocabulary, and literacy of African language – English bilinguals

Very few longitudinal studies have examined both phonological processing and literacy variables. The available longitudinal studies show that PA scores do improve over time. Khosa (2021) assessed 75 children at the start and end of first grade in L1 Xitsonga. At the first time point (start of grade 1), children's scores on syllable and phoneme awareness tasks were close to zero after two months of instruction. By the end of first grade, half the children were able to complete the tasks correctly. Makaure (2021) sheds light on both L1 Northern Sotho and English PA development in grade 2. Again, PA scores generally increased from the start of grade 2 to the end of grade 2 for L1 Northern Sotho blending and L1 and English sound matching. The English blending development depended on MOI. Scores decreased for the group of children in Northern Sotho MOI and increased for the group in English MOI from the start to end of grade 2.

The unique contribution of predictors to reading outcomes has been established using multiple regression. Whether a predictor has a significant effect depends on the stage in reading development, how the variables were measured, the sample size, as well as which predictors are included in the model. In first grade, the findings are mixed about the effect of L1 PA on later L1 reading. Schaefer and Kotzé (2019) present data from more than 1200 children. They found that L1 isiZulu/Siswati phoneme isolation and letter sound fluency measured at the start of grade 1 significantly predicted both L1 and English word reading and English letter sound fluency at the end of grade 1 to a similar extent after controlling for L1 and English vocabulary, PWM (digit span), and L1 listening comprehension. L1 PA and letter sound knowledge also made small but significant contributions to English spelling at the end of the year. Khosa (2021) did not find a significant effect of start of grade 1 PA on end of grade 1 word reading when controlling for letter sound fluency for L1 Xitsonga, but her sample was smaller (75 children). Makaure (2021) found that grade 2 tasks of PA, PWM and RAN measured in Northern Sotho were significantly related to reading comprehension measured at the end of grade 3. Tasks of PA, vocabulary and early writing in grade 2 were significantly related to spelling ability at the end of grade 3.

2.7.3 The research gap: What we still don't know about phonological processing and literacy of African Language – English bilinguals

This brief review of cross-sectional and longitudinal research on the relation between phonological processing and reading in African languages and English (L2) shows that the findings from international research on alphabets is largely supported for African languages, for those in the Nguni and Sotho language groups. Nevertheless, it is still worthwhile to continue examining phonological processing and literacy development in these languages to identify whether some aspects may be language dependent. The existing research in South Africa is predominantly cross-sectional and drawn from samples of third graders. Studies typically do not examine the variables in both the languages the children know, with the exception of the comprehensive measurements by Makaure (2016, 2021) in Northern Sotho. This makes it difficult to explore which aspects of phonological processing and literacy development may be language and/or time specific. Theoretically, in transparent languages, reading develops rapidly early on in literacy instruction, so it would be insightful to examine development already from first grade.

Of practical relevance is whether research on phonological processing and literacy development from one African language can be applied to closely related African languages (such as isiXhosa and isiZulu), or more broadly, whether research on consistently written languages can be applied to all other consistently written languages. If the development of these skills is similar across these languages, then this reduces the cost of further research (because what is found for one language applies to another). However, if development is very different when using similar instruments, this suggests that research is required in each language to inform literacy instruction. The availability of parallel research instruments in different languages constrains such cross-linguistic comparison across studies. The EGRA is an exception here and has been used successfully to measure literacy skills in a standardized format across African languages. Assessments of phonological processing skills for the primary grades does not have such parallel tests making direct comparisons across studies difficult. This may be why few studies directly compare two groups of children who use closely related languages.

Finally, as the research field has developed, researchers have started including multiple measures of the same construct to enhance the validity and reliability of their claims. Researchers have also predominantly used regression techniques. These techniques are appropriate to answer the research questions. The use of more advanced regression techniques, such as latent variable modelling, have, however, not yet been fully explored. Latent variable modelling has several advantages over multiple regression in that it enables the estimation of measurement error and allows the researcher to statistically test competing theoretically motivated models, or to test for the measurement invariance of their research instruments. Techniques such as confirmatory factor analysis allow the researcher to confirm how indicator variables (or tasks) are related to the construct of interest, which allows the researcher to confirm the validity of their instruments as well as reduce the number of predictors in the model, making interpretation simpler.

In this overview, I have identified avenues to explore in terms of the within-language and cross-language relations between phonological processing skills and literacy in L1 and L2 across the early grades in South Africa. Examining the same skills in two closely related languages using parallel tests would inform whether the within-language and cross-language relations and longitudinal development are similar, which, in turn, will provide insight into reading instruction in the tested languages. To address this research gap, my aim in the present study is to explore the longitudinal development of and the within-language and across-language relations between phonological processing and literacy skills in L1 isiXhosa, L1 isiZulu, and L2 English for two groups of children from first grade to third grade. My study builds on that of Makaure (2021) by examining two different language groups (only in L1 MOI schools).

2.8 CONCLUSION

In this review of the literature, I have defined the key constructs of the study which are literacy and its sub-skills (letter knowledge, decoding and word recognition, reading fluency and reading comprehension), phonological processing sub-skills (PA, PWM and RAN) and vocabulary. Through reference to research on various languages I established that phonological processing skills are causally related to literacy development cross-linguistically, but that some aspects of this development (such as rate of development) are language specific based on the language characteristics or educational context. I also reviewed research from South Africa on how phonological processing skills are related to reading both within and between languages for bilingual readers. In my study I address the lack of longitudinal research on phonological processing and literacy development for L1 African language and L2 English readers in South Africa. I address both the longitudinal development of skills, as well as the within language and between language associations of the skills in L1 and L2. In addressing this gap, I seek to contribute to the growing understanding of language universal and language specific aspects of phonological processing and literacy development and their associations for bilingual readers. This contribution is strengthened by comparing the development and associations of these skills for two groups of children learning to read in two closely related languages (isiXhosa and isiZulu) and using parallel tests to measure the constructs.

3 Chapter 3. Methodology

3.1 INTRODUCTION

In this chapter I present the research paradigm, approach, and design I used for this study, followed by a discussion of ethical considerations related to the study. I, then, present a summary of the phonological, morphological, and orthographic differences between English and isiXhosa and isiZulu which were considered in developing the research instruments. Following this, I present information about the research participants, instruments, data collection and data analysis procedures. I end the chapter with the presentation of the results from the pilot study which showed that the research instruments were valid, reliable, and could feasibly be used with the intended research participants.

3.2 RESEARCH APPROACH AND DESIGN

I used a quantitative approach with a longitudinal quasi-experimental[15] research design to examine the relationships between phonological processing and literacy for the isiXhosa and isiZulu groups over three points in time.

The quantitative approach to research involves operationalising constructs into measurable attributes, which are awarded numerical values. The operationalisation of variables is addressed later in this chapter. I used the quantitative approach as it aligns well with the view of literacy as a set of sub-skills that can be statistically related to one another, as well as to other linguistic skills. In this study, the phonological processing skills (PA, PWM and RAN) are the independent variables, and literacy skills are the dependent variables. Vocabulary was included as a control variable. In quantitative research, standardized effect sizes (such as r or d) can then be used to compare the results of the current study to other studies. Furthermore, the calculation of confidence intervals presents the level of uncertainty related to estimates. In some analyses, I used latent variable modelling, which better accounts for measurement error. In these ways, I was able to better isolate the influence of the sub-skills on one another and minimise the influence of measurement error in the estimates.

I chose an experimental design, specifically, a quasi-experimental design, so that I could compare the phonological processing and reading development of two groups of children with similar languages. A true experiment entailing random assignment of participants with variable manipulation was not conducted since the participants were already assigned to classrooms in each school. In this study, the

[15] One examiner pointed out that the study is better described as a "two groups correlational design" as not all confounding variables have been measured as would be the case in a quasi-experiment.

variable that differed between the groups was the participants' first language which overlapped with the school MOI.

Longitudinal research designs involve collecting data from the same group of participants at more than one point in time. Longitudinal research designs allow researchers to identify how variables change or remain stable over time (Phakiti & Paltridge, 2015). Additionally, the results of longitudinal research designs can have causal interpretations when sufficient variables have been assessed at each time point to establish precedence (Hulme & Snowling, 2013). I collected data three times over 29 months (8 school terms) from 2019 to 2021 while the participants were in grade 1 (t1; term 2 and 3)[16], at the start of grade 3 (t2; term 1), and near the end of grade 3 (t3; term 3). L1 and English vocabulary were assessed at t1 (term 2) only as they were control variables. Phonological processing skills (the independent variables) were assessed at t1 and t2. Letter recognition fluency, word reading, oral reading fluency and spelling were measured at all three time points. Reading comprehension was measured at t3 only once children had had sufficient literacy instruction. I had originally intended to collect phonological processing and literacy data at three evenly spaced intervals in grades 1, 2 and 3. This plan had to be changed in response to the COVID-19 impact on education. The schools were closed for a large part of 2020 when the participants were in grade 2. More information about the COVID-19 impact on education in South Africa is presented in section 3.3.3. Cross-sectional data analysis was conducted for t1 and t2 data to better understand the concurrent within and across-language relationships of phonological processing and literacy within each grade. Cross-sectional analysis of the t3 literacy data was also conducted. A final longitudinal analysis was conducted of t1 phonological processing and vocabulary predicting t2, and t3 literacy outcomes, and of t2 phonological processing predicting t3 literacy outcomes to determine the within- and cross-language longitudinal predictors of literacy. In addition to the participant data, a sub-set of parents completed a home background questionnaire via telephonic structured interview. This quantitative questionnaire collected data on the parents' and participants' language and literacy exposure and included questions about the educational support provided during the COVID-19 pandemic related school closures. This contextual information provided by some of the parents in this questionnaire is referred to in the current chapter.

[16] The grade 1 timepoint when literacy was measured is referred to as "end of grade 1" (t1).

3.3 RESEARCH CONTEXT

The research took place in three conveniently sampled public government schools in two provinces (Eastern Cape and Gauteng) in South Africa. One school was selected from a semi-urban township on the outskirts of East London, Eastern Cape. This school (called school X1 hereafter) used isiXhosa as the MOI. To meet the expected sample size, two schools that offered isiZulu as the MOI (called school Z1 and school Z2 hereafter) were selected from an urban township called Atteridgeville near Pretoria, Gauteng. School X1 had between 40-50 children per class, and schools Z1 and Z2 had about 40 children per class. All three schools served low-income communities[17], and all learners received meals from the National School Nutrition Program. None of the schools had school libraries.

3.3.1 Provincial context

Some differences between provinces deserve mention. In Gauteng, there is more variety in the languages which are spoken, whereas, in the Eastern Cape, most people speak isiXhosa as their first language (Statistics South Africa, 2012). English use (as first or additional language) is more widespread in Gauteng as well. I observed that the language profile of each province was mirrored in the schools and the communities the schools were in. Secondly, Gauteng is a wealthier province than the Eastern Cape, and this was reflected in the state of the school buildings of the sampled schools and the (lack of) access to resources.

3.3.2 Teaching context

All schools followed the national curriculum stipulated in the Curriculum and Assessment Policy Statement (Department of Basic Education, 2011b, 2011a). IsiXhosa or isiZulu was offered at the Home Language level (7-8 hours per week) and English was offered at the First Additional Language level (EFAL) (2-3 hours per week from grades 1 to 2, and 3-4 hours in grade 3). Assuming a school year is 42 weeks and that the school offers the minimum hours for Home Language and maximum hours for EFAL, a child would receive a total of 882 hours of Home Language and 420 hours of English additional language instruction at school in total by the end of grade 3[18].

[17] Specifically, these schools were quintile 2 and 3 schools. South African government schools are classified into five groups called quintiles based on the socioeconomic status of the area they serve. Quintile 1 schools serve the poorest communities and quintile 5 schools serve the wealthiest communities. Quintile 1 to 3 schools do not charge fees and receive an allocation from the government per learner per annum that is almost twice as much as the allocation for quintile 4 schools, and more than five and a half times more than the allocation to quintile 5 schools (South African Schools Act, 1996 (Act No 84 of 1996) Amended national norms and standards for school funding, 2020).

[18] I did not record the timetables that were used at each school. These numbers likely reflect maximum possible hours. The curriculum was trimmed in light of the COVID-19 pandemic school closures, but it is still unlikely that children received the total time allocated in language instruction.

The South African language teaching curriculum for public schools is based on additive bilingualism (Department of Basic Education, 2011b). The curriculum rests on the assumption that first language and literacy skills are transferred, or support, language and literacy in the additional language (Schaefer & Kotzé, 2019; Wildsmith-Cromarty & Balfour, 2019). From grade 1, the focus of teaching in Home Language is on all four language skills (listening, speaking, reading, and writing). Building oral proficiency (listening and speaking) is the focus for the FAL subject in grade 1, with all four skills being explicitly taught from grade 2. The Home Language curriculum does not explicitly acknowledge the teaching approach or method used, although many techniques for teaching (especially reading) are included. Implicit in the curriculum is the communicative language teaching approach, with writing taught through process and genre writing approaches. The teaching approach is much more explicit in the FAL curriculum, with support for the communicative language teaching approach, process and genre writing approach, and, especially in grade 1, Total Physical Response (Wildsmith-Cromarty & Balfour, 2019).

During the school recruitment process, I made every effort to ensure that the schools were not part of any active interventions. However, upon returning to do data collection in 2021, I found out that the isiXhosa school was part of the Funda Wande intervention group. Funda Wande was a randomised control trial which compared the efficacy of a teacher coaching and materials provision model to support L1 isiXhosa literacy to a group of 'business as usual' control schools. An independent evaluation of the program found the intervention to be effective in improving PA, L1 letter recognition fluency, and L1 word and text reading fluency (Ardington & Meiring, 2020). Thus, while all schools followed the South African curriculum, it may be possible that the isiXhosa teachers were better implementing the Home Language subject, based on the average improvement in the Funda Wande intervention.

3.3.3 The impact of the COVID-19 pandemic on schooling and learning

The COVID-19 pandemic affected the quantity and quality of teaching time learners received in 2020 and 2021 and the educational support received by learners varied. In 2020, when the participants were in grade 2, schools were shut down after three months of instruction (in March) and reopened only five months later (at the end of August)[19]. Thereafter, schools used rotational timetabling so that only half the students were present on any given day. The rotational timetabling continued into 2021 (when most participants were in grade 3).

[19] Some grades had returned to school before August 2020, but I have focussed only on grade 2 as it is the grade that most of the participants were in at the time.

Informal discussions with one teacher in each school revealed that learners in Schools Z2 and X1 received no additional learning support from the schools in April to June 2020. At School Z1, the teachers used social media messaging to communicate learning goals using the government provided workbooks during school shut down. When lockdown restrictions were eased in August 2020, School Z2 began a home learning program where work plans were sent to parents via social media messaging. According to the teacher at School X1, instructions for work to be done at home was provided for students by only some teachers between June and August 2020. These findings were mirrored in what parents reported in a structured telephonic interview. Of the total 72 parents who participated, 15 parents (21%) reported that their child did not engage in any educational activities during the lockdown in 2020, while only a quarter (10 in the isiXhosa group, 8 in the isiZulu group) reported that their child completed work sent by the teacher. In 2021, almost three quarters of parents said their child completed work sent by the teacher on "school off days" (23 isiXhosa and 27 isiZulu parents), but the number of children who did not engage in any reported educational activities remained the same (8 per group, or 22% of the sample).

Ardington et al. (2021) examined learning losses due to the lockdowns by comparing a 2020 cohort to earlier cohorts revealing that the lower quantity and quality of instruction impacted learning in South Africa. They estimated that because of pandemic related school closures learners in a sample of Eastern Cape schools were in school for approximately 40% of the total days in the typical school calendar. The resulting learning loss was estimated at 57% to 70% of a year's learning for reading fluency. In raw scores, grade 2s in 2020 could read 16 fewer letter sounds per minute and could read 7 fewer words per minute in isiXhosa, than similar grade 2s in 2019. The consequence of this lack of access to (quality) instruction resulted in flatter reading fluency trajectories than in pre-pandemic years (Ardington, Wills, & Kotze, 2021). The results of my study should, therefore, be interpreted considering the quantity and quality of instruction children received in 2020 and 2021.

3.4 PARTICIPANTS

The participant characteristics at each time point in the main study are presented in Table 3-1. There were 139 participants (56% girls) at t1, and 122 participants (55% girls) were assessed again at t2 and t3. This is an attrition rate of 12%. There were no significant differences in the grade 1 scores of participants who did and did not remain in the sample, and the effect sizes were negligible to very small. Of those participants who were present at school in 2021, 25 children (21%) had repeated a grade and were still in grade 2.

I intended to randomly sample children from grade 1 classes in each school. An insufficient number of consent forms were returned for this sampling method, so I used non-random convenience sampling. All participants in grade 1 who returned consent forms filled in by their parents/guardians and who did not meet the exclusion criteria were included in the study. Exclusion criteria included: learning or physical disabilities known to the teacher, child had repeated grade 1 according to school records or teacher report, child was too "young" or "old"[20] for grade 1 according to birth date data on school system, and child did not use isiZulu or isiXhosa at home according to participant and teacher report. Twenty participants from each school who returned consent forms were randomly selected to participate in the pilot study (see section 3.9.2). The remaining participants were included in the main study.

Between t2 and t3, parents and guardians were invited to participate in a structured telephonic interview. Approximately half (71) of the parents/guardians agreed to participate. Information was collected on socioeconomic status (highest education level, occupation, and number of assets), and the parents' and participants' language and literacy exposure. Table 3-1 includes information from the structured interview. More detail about the parent interview is presented in section 3.7.4. There were some differences in the parent self-reported socio-economic status indicated by education, income, occupation and assets, and language and literacy exposure. Altogether, Table 3-1 shows that the isiZulu participants self-reported a higher socioeconomic status according to the number of assets, more reading exposure, and exposure to more languages. More isiXhosa parents had earned an income in the two weeks prior to the interview; 24 isiXhosa and 12 isiZulu parents reported earning an income. The results of participants whose parents agreed and did not agree to be interviewed were compared to determine if parents self-selected only if their children performed better at school. The comparison showed that there were very few differences in the participants results for those whose parents did and did not participate in the interviews at t1, and t2. However, at t3, the participants whose parents participated in the interviews had slightly better English word reading and L1 oral reading comprehension (small to medium effects). Most of the evidence suggests that there was no systematic bias in which parents responded to the interview or not.

[20] Being too "young" or "old" for grade 1 is not completely objective. The intention was to include participants between the ages of 6.5 and 7.5 years. However, this decision was relaxed in order to reach the intended sample size. Given that legislation allows children to enter grade 1 in the year they will turn 6 in July, children as young as 5 years 11 months were included (the research began in July and August 2019). Children as old as 7 years 9 months were also included (as long as school records indicated that a grade was not repeated). It is possible that school records were not accurate, and some participants included in the study could have indeed repeated first grade.

Table 3-1. Sample size and age at t1– t3, and home background information per group

Time point	isiXhosa Group	isiZulu Group	Total
T1 – End grade 1			
Total participants	69	70	139
Girls (%)	39 (57%)	39 (56%)	78 (56%)
Age: Mean (SD)	6.9 (0.5)	6.8 (0.4)	6.9 (0.4)
T2 & T3 – grade 3			
Total participants	62	60	122
Girls (%)	36 (58%)	31 (52%)	67 (55%)
Age at t2: Mean (SD)	8.5 (0.5)	8.4 (0.4)	8.4 (0.4)
Proportion in grade 2	15 (24%)	10 (17%)	25 (21%)
Parent Interview – mid grade 3			
Number who agreed to participate	35	36	71
Socio-economic Status			
Highest education level			
Certificate/Diploma	3 (9%)	10 (28%)	13 (18%)
Matric (Grade 12)	5 (14%)	8 (22%)	13 (18%)
Grade 10/11	12 (34%)	13 (36%)	26 (37%)
Grade 7/8/9	10 (29%)	3 (8%)	13 (18)
Upper primary	4 (11%)	-	4 (6%)
No schooling	-	1 (3%)	1 (1%)
Unreported	1 (3%)	1 (3%)	2 (3%)
Earned an income in last two weeks	24 (69%)	12 (33%)	36 (51%)
Occupation: ISCO codes (% of those who earned an income)			
Group 9, e.g., cleaner	16 (67%)	2 (17%)	18 (50%)
Group 5 (service and sales), e.g., cashier, security	5 (21%)	6 (50%)	11 (31%)
Group 4 (clerical support), e.g., merchandiser, receptionist	1 (4%)	2 (17%)	3 (8%)
Group 2 (professionals), e.g., teacher	1 (4%)	2 (17%)	3 (8%)
Unreported	1 (4%)	0	1 (3%)
Mean Number of Assets (SD)*	4.6 (1.3)	5.8 (1.9)	5.2 (1.7)
Literacy Experience			
Parent never reads to the child	19 (54%)	13 (36%)	32 (45%)
Child never reads to the parent	17 (49%)	7 (19%)	24 (34%)
No children's books in the home	21 (60%)	22 (61%)	43 (61%)
Child reads well/very well in L1	23 (66%)	34 (94%)	57 (80%)
Child writes well/very well in L1	23 (66%)	35 (97%)	58 (82%)
Child reads well/very well in English	2 (6%)	11 (31%)	13 (18%)
Child writes well/very well in English	3 (9%)	10 (28%)	13 (18%)
Language Exposure			
Child mean age learning English	6.1 years (1.2)	5.9 (1.1)	6 years (1.1)
Parent mean age learning English	13.3 years (3.8)	8 years (6.3)	10.9 years (5.7)
Number of languages known receptively by child	2 (0)	3 (0.5)	2.5 (0.6)

Time point	isiXhosa Group	isiZulu Group	Total
Number of languages known receptively by parent	2.4 (0.5)	2.9 (1.1)	2.6 (0.9)
Number of languages child can speak well/very well	1.0 (0.4)	2.3 (0.8)	1.7 (0.9)
Number of languages parent can speak well/very well	1.8 (0.6)	2.7 (1)	2.3 (1)

Notes: * The asset list included: electricity, TV, radio, computer/laptop/tablet, fridge, flushing toilet, running water in the house, cell phone, bicycle, car. The isiZulu group of parents had significantly more assets from the asset list than the isiXhosa group, t (70) = -3.13, p = .003, d = -0.74, 95% CI [-1.21; -0.26].

3.5 ETHICAL CONSIDERATIONS

Ethical principles, including respect for persons, beneficence and justice (National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research, 1979), were adhered to in the research. Ethical clearance from the University of South Africa was sought after the research proposal was accepted and before any requests for participation were sent to education departments, schools, or participants. Institutional ethical clearance was granted on 1 March 2019 by the College of Human Sciences Ethics Review Committee (NHREC registration: Rec-240516-052; CREC Reference: 2019-CHS-0245). Ethical clearance from the provincial departments of education was also requested and received for each year of the study. These ethical clearance certificates are presented in appendix A1 in section 9.1.

After receiving institutional clearance, I contacted the school principals, who gave their consent to the research in the schools. I made appointments with the school principals who introduced me to the Foundation Phase heads of department and teachers, whom I asked for verbal consent to conduct research with children in their classrooms. After being granted consent from the relevant authorities I distributed parent/guardian consent forms to all children in grade 1. Participants who returned signed consent forms were invited to participate and gave their verbal assent to be assessed. In grade 3, another consent form was sent out which requested parent contact details. Parents who returned this form were phoned and invited to participate in the parent telephone interview. At all stages, participants and relevant authorities were informed that participation was optional and could be terminated at any time without consequence. The informed consent documents are available in appendix A2 in section 9.2.

3.6 THE LANGUAGE STRUCTURES OF ISIXHOSA, ISIZULU AND ENGLISH

This section provides an overview of the phonological, morphological and orthographic features of isiXhosa, isiZulu and English. These language characteristics were considered in developing the assessments, described in section 3.7. IsiXhosa and isiZulu are both from the Nguni group of the Southern Bantu languages and are closely related (Doke, 1956). English is an Indo-European language. A comparison of the languages is presented in *Table* 3-2 and discussed below.

Table 3-2. Comparison of phonological, morphological, and orthographic features of isiXhosa, isiZulu, and English

Language	**Vowels**	**Consonants**	**Morphology**	**Orthography**
English	20	24	Analytic	Alphabetic - inconsistent
isiXhosa	5	52	Agglutinating	Alphabetic (conjunctive) - consistent
isiZulu	5	44	Agglutinating	Alphabetic (conjunctive) - consistent

IsiXhosa and isiZulu, like other Southern Bantu languages have five vowel phonemes /a e i o u/ (Doke, 1956). Vowel length in isiXhosa is contrastive only for /i/ and /o/ to indicate the plural morpheme. For example, [iŋǀwadi] (*incwadi*, book-SG) becomes [i:ŋǀwadi] (*iincwadi*, book-PL). This is indicated by a doubled vowel in the orthography of isiXhosa. On the other hand, English has 20 vowel phonemes (Bates, 2018), including short and long vowels, and diphthongs, but due to the many dialects of spoken English there is some variation in this number (Kessler & Treiman, 1997). isiZulu and isiXhosa have a much larger consonant inventory than English. Whereas English has 24 consonant phonemes, isiXhosa has 52 and isiZulu has 44 plain and click consonants (Dent & Nyembezi, 2009; Vanderstouwe, 2009). isiXhosa and isiZulu have an open, simple consonant-vowel (CV) syllable structure with words rarely ending in a consonant. The syllable structure is therefore usually V or CV. Consonant clusters (where consonants occur one after the other with no intervening vowel) occur only in loan words. Furthermore, both isiXhosa and isiZulu have an agglutinating morphology where morphemes are affixed to noun and verb roots (Doke, 1956).

The affixation of grammatical morphemes to root morphemes can result in phonological changes to the root and affixes (Nurse & Philippson, 2003). These changes include vowel elision, vowel coalescence (when two vowels influence each other), and consonantalization (G. Sibanda, 2009; Taljard & Bosch, 2006). These phonological changes due to morphological processes are common in the Nguni languages. As such, these languages were committed to paper using a conjunctive alphabetic writing system (Taljard & Bosch, 2006). In conjunctive writing, the affixes are added to a noun or verb root with no orthographic spaces in between. This system of writing captures the changes to phonology in the orthography (example 1). As a consequence of the conjunctive writing system, words in isiXhosa and isiZulu are much longer than English words on average. A sentence which consists of many words in English can be written as one orthographic word in isiXhosa and isiZulu. Examples 2 and 3 show how a short sentence in English of two words is written as one long word in isiXhosa and isiZulu. Nevertheless, isiXhosa and isiZulu are written very consistently, unlike English.

(1)	Conjunctive writing:	Wayesezofika ekhaya.	(isiZulu)
	Disjunctive writing:	*W a ye s' e zo fika e khaya 'He would have arrived home.' (Taljard & Bosch, 2006, p. 433)	

(2)	Ndiyathetha. →	ndi-ya-theth-a SM1SG-DIS-speak-FV 'I speak' (Diemer, 2015, p. 20)	(isiXhosa)
(3)	Ngiyakhuluma. →	ngi-ya-khulum-a SM1SG-DIS-speak-FV 'I speak' (translation of (2))	(isiZulu)

With regards to orthography, all three languages use the 26 letters of the Latin alphabet. However, all three languages have more than 26 phonemes. As described in section 2.2.1.3, letters are grouped together into multi-letter groups to represent these different phonemes. For example, in English, /tʃ/ is represented as *ch* (e.g., *chip*) at the start of words and *tch* at the end of words (e.g., *catch*). In isiXhosa and isiZulu, /tʃ/ is represented by *tsh* (e.g., *titshala – teacher*). Although all three languages use multi-letter units to represent all the phonemes in the language, isiXhosa and isiZulu are written much more consistently than English. Nevertheless, readers of isiXhosa and isiZulu will still need to learn many grapheme-phoneme correspondences at the letter and multi-letter unit level (J. Katz & Rees, 2022).

From this brief comparison of the phonology, morphology, and orthography of these languages above, it can be seen that English differs from isiXhosa and isiZulu in terms of their orthography, phonology and morphology, but isiXhosa and isiZulu are very similar. These differences, compared to English, may affect how various dimensions of phonological processing contribute to literacy development in the Nguni languages.

3.7 RESEARCH INSTRUMENTS

Standardised tests were used to measure English word reading, English phonological processing, and English receptive vocabulary. As far as possible, existing isiXhosa and isiZulu instruments which had been previously used in large scale studies in South Africa were used. Where they were not available, I adapted the English standardised tests into isiXhosa and isiZulu, so that constructs were assessed similarly across L1 and English. The differing language structures between English and isiXhosa/isiZulu meant that the L1 item characteristics were not always equivalent to the English items in terms of syllable length and structure, but the isiXhosa and isiZulu tests were developed to be parallel measures. Dictionaries with word frequency data were used to ensure that the isiXhosa and isiZulu items were likely well known to each group of participants. Where possible, all constructs were measured with more than one task so that each construct was measured more comprehensively. This design choice also allowed the quantification of measurement error through use of latent variable modelling approaches. The use of standardised tests, and tests already used in South Africa also allowed me to contextualise and compare the raw scores with other similar participants.

The L1 vocabulary and L1 phonological processing tasks were piloted before the main study commenced. I present the results of the pilot study at the end of this chapter, in section 3.9. I address the final data-collection instruments used in the study in section 3.7. Where relevant, I note the changes made to the pilot instruments for the main study. All instruments were administered individually unless otherwise specified. The tests I developed for this study are included in Appendix A3 in section 9.3, and are available for re-use (with attribution) online at https://osf.io/gmnws/.

3.7.1 Literacy

Letter-sound correspondence fluency, isolated word reading, connected text reading, reading comprehension, early writing and spelling from dictation were assessed. These are explained in more detail below.

3.7.1.1 Letter-sound correspondence fluency – L1

Letter-sound correspondence fluency was measured in L1 only using the letter-sound recognition task from the EGRA used to assess isiZulu and Siswati literacy in the EGRS 2 (Department of Basic Education, 2019b). The isiZulu task was adapted into isiXhosa. The task was only administered in L1 because many English and L1 letter-sound correspondences are the same. Nevertheless, the task includes L1 specific letter-sound correspondences and participants were told that they were written in L1. The task involved timed reading of letters (e.g., *m, h*) and letter groups (e.g., *th, hl*) in a 10 by 11 matrix. The task was preceded by a practice trial of four letters (*g*, *n*, *d*, and *a*) where children received corrective feedback. The final letter or letter group read in one minute was recorded and errors were also recorded. The task was discontinued if participants were unable to read the first five letters or if they made five consecutive errors. Total errors were subtracted from the total letters attempted for a correct letters per minute score used in the analyses. This task will be referred to as letter recognition fluency (LRF).

3.7.1.2 Isolated word reading - English

Phonological recoding and lexical-semantic word reading processes in English were measured using the word reading (nonword, exception and regular word reading) tasks from the Diagnostic Test of Word Reading Processes (DTWRP) (Forum for Research in Literacy and Language, Institute of Education, 2012). The DTWRP is a standardised test used to measure the word reading skills of children between the ages of 5 and 12.

During the administration of the DTWRP, participants were presented with a chart of words which they are asked to read aloud, with no time limit. There were three lists of 30 words all preceded by instructions. The nonword reading task contained colour images of "alien" creatures, and pseudo-English words (e.g., *vip*, *tek;* Forum for Research in Literacy and Language Institute of Education, n.d.). Participants were told that the words are "alien" words. Phonological recoding has to be used to read these words correctly. Participants' lexical-semantic word reading processes were assessed with the irregular (exception) word reading list (e.g., *what*, *people;* Forum for Research in Literacy and Language Institute of Education, n.d.). Participants also read a regular word list (e.g., *frog*, *hill;* Forum for Research in Literacy and Language Institute of Education, n.d.). Regular words can be read either through phonological recoding or a lexical-semantic reading process.

The tasks were administered according to the test manual. Participants received no feedback (except to move to the next word), were asked to stop reading after five consecutive errors, and were asked to blend sounds together if they only sounded letters out individually (Forum for Research in Literacy and Language Institute of Education, 2012). As suggested in the test manual for young test takers, a blank page was used to cover the rows that were not yet being read. The test is usually untimed and was not timed in grade 1. The total time to read each set of words was recorded in grade 3 (t2 and t3) so that word reading fluency could also be calculated. The reliability of the test in the current sample was excellent (*Table 3-3*).

Table 3-3. Internal consistency of the English Diagnostic Test of Word Reading Processes estimated with Cronbach's alpha in the current sample

	All			isiXhosa			isiZulu		
Timepoint	**T1**	**T2**	**T3**	**T1**	**T2**	**T3**	**T1**	**T2**	**T3**
Total (90)	.96	.98	.98	.96	.97	.98	.97	.99	.99
Nonwords (30)	.89	.95	.95	.86	.91	.96	.94	.96	.95
Exception Words (30)	.92	.96	.95	.90	.95	.95	.94	.96	.95
Regular Words (30)	.95	.96	.97	.94	.94	.97	.96	.97	.98

Notes: Words not attempted were recoded to zero score otherwise analysis would not run.

3.7.1.3 *Isolated word reading – L1*

Isolated real word reading in isiXhosa and isiZulu was measured using a task designed to be similar to the English word reading tasks. Nonword reading was not measured in L1 because it correlates very strongly with real word reading in African languages (e.g., r = .91 for Setswana; Taylor et al., 2017) and would add time to testing without necessarily offering new information. There are no exception words in isiXhosa or isiZulu because these languages are written with transparent orthographies.

Parallel word lists of 20 items were created for isiXhosa and isiZulu. Dictionaries (de Schryver, 2014; de Schryver & Reynolds, 2014) were used to identify high frequency words that had the same or almost the same spelling, same meaning and same frequency in both languages. The final list included 10 words in the top 500 most frequent words, four words in the 501-to-1000-word frequency level, four words in the 1001-to-1500-word frequency level and two words from the 1501 to 5000-word frequency level. The words were presented in descending order of frequency. Similar administration procedures were followed as those used in the DTWRP (see section 3.7.1.2). The internal consistency of the test was acceptable at each time point (*Table 3-4*).

Table 3-4. Internal consistency of the L1 word reading task estimated using Cronbach's alpha

Timepoint	All	isiXhosa	isiZulu
T1 - Grade 1	.88	.97**	.97**
T2 - Start of grade 3	.86	.87	.87*
T3 - End grade 3	.97**	.98**	.96**

Notes: Unless otherwise specified, analysis uses available data (including missing data). ** All words not attempted were recoded as zero to allow analysis to run. * Cronbach's alpha calculated on words 1 – 18 for the isiZulu group, because there were too many missing values for 19 and 20.

3.7.1.4 *Connected text reading – L1 and English*

The ability to read connected text was measured by asking participants to read a grade level text aloud within one minute. Tasks from EGRAs from previous studies in South Africa were used. The tasks were, therefore, not piloted before the main study. For each text, participants were told they were going to read a story. The title was pointed out to the participants and read aloud by the researchers. The timer was started when participants began reading. Participants received no corrective feedback, and the task was discontinued after five consecutive errors. After one minute had passed, the researcher asked participants to stop reading. Errors were recorded on the score sheet and subtracted from the total number of words attempted to provide a correct words per minute (cwpm) score. Where participants completed the task before the time was up, the total time used was recorded and the score was converted to cwpm score. The L1 and English cwpm scores should not be directly compared due to average word length differences across languages (Spaull et al., 2020), as mentioned in section 3.6. However, the isiXhosa and isiZulu scores can be directly compared due to very similar written language characteristics.

The total number of words and average letters per word per text and grade are presented in *Table 3-5*. The same text ("Jabu and his dog") was used in grade 1 in English (Department of Basic Education, 2018), and its translation in isiXhosa and isiZulu[21] (ERA, 2016b, 2016c). Grade 2 level texts were used for the start of grade 3 assessment, due to possible negative effects on reading ability from the COVID-19 school closures in 2020 when participants were in grade 2. The grade 2 L1 texts were based on a folktale about how a traveller made soup from stones (ERA, 2016d, 2016e). The English text from grade 1 was used in grade 2 due to floor effects in English reading, and since the task had originally been used for a grade 2 sample (Department of Basic Education, 2018). The grade 3 texts from Wave 4 of the EGRS 2 (Department of Basic Education, 2019b) were used at t3. The isiZulu text was adapted into isiXhosa for the current study. The L1 texts included a version of the stone soup story used at the start of the year. The English text was a folktale about how the elephant got its trunk.

Table 3-5. Total words and mean letters per word for texts used in each language and grade

	isiXhosa		isiZulu		English	
Timepoint	**Total words**	**Mean letters per word**	**Total words**	**Mean letters per word**	**Total words**	**Mean letters per word**
T1 - Grade 1	56	6.4	56	6.8	70	3.6
T2 - Start of grade 3	55	7.1	59	7.1	70	3.6
T3 - End grade 3	58	7.1	58	7.0	126	4.0

Oral reading fluency tasks are easy to administer which supports their reliability. Concurrent test-retest reliability data is not available for the particular tasks used in the current study. However, data from the EGRS II (Siswati and isiZulu) present evidence that the one-minute reading tasks are reliable (at least in grade 3). Test-retest reliability was calculated by administering the same task on the same day by different scorers. Data for the isiZulu group only is presented for its relevance to the current study. The correlations between the first and second administration for the English and isiZulu text reading tasks were strong indicating that they are reliable (isiZulu: r = .87, 95% CI [81; .92], N = 81; English: r = .89, 95% CI [.83; .92], N = 87, *own*

[21] The ERA literacy tests were adapted and modified from the original isiXhosa and isiZulu EGRA tests received from the Eastern Cape provincial department of Basic Education. Funded by Zenex, Dr Lauren Wildschut from ERA and Prof EJ Pretorius from Unisa adapted, piloted, and revised the original EGRA assessments during 2015-2016.

calculations; Department of Basic Education & University of the Witwatersrand, 2020). The oral reading fluency tasks also demonstrated strong correlations with reading comprehension in isiZulu (r = .79, 95% CI [.69; .86], N = 87, *own calculations;* Department of Basic Education & University of the Witwatersrand, 2020) indicating that the construct validity is sufficient. However, due to floor effects in the English comprehension task in grade 3, correlations between oral reading fluency and comprehension lower (r = .64, 95% CI [.5; .75], N = 87, *own calculations;* Department of Basic Education & University of the Witwatersrand, 2020).

3.7.1.5 Reading comprehension – L1 and English

Reading comprehension was assessed at the third time point (end of grade 3) only in two ways. The first reading comprehension measure in each language included questions asked after the orally read texts in the individual testing sessions. Participants were asked questions based on how far they had read in the story. There were five questions for L1, and five questions for English. The second reading comprehension measure was a group administered written test taken from the EGRS 2 (Department of Basic Education, 2019b) and adapted into isiXhosa. This comprehension test has a similar format to reading comprehension tests used in school. Participants read the story silently and then answered questions. Most questions had an open-ended format, with one multiple choice question in the L1 test. There were 149 words in the isiXhosa story, 140 words in the isiZulu story, and 57 words in the English story. The isiXhosa and isiZulu stories were followed by six questions, and the English story was followed by four questions. The internal reliability for each task is presented in *Table 3-6*. All tasks had reliability above .7 except for the English comprehension tasks for the isiXhosa group, possibly because they had low English vocabulary, compared to their decoding ability. Nevertheless, when reliability was calculated for all the reading comprehension questions for each language, the reliability was .76 for the isiXhosa group, and therefore acceptable.

Table 3-6. Internal consistency of the L1 and English end of grade 3 reading comprehension tasks estimated using Cronbach's alpha

Task (Max Score)	**All**	**isiXhosa**	**isiZulu**
L1 RC oral (5)	.83	.76	.89
L1 RC written (6)	.83	.76	.88
English RC oral (5)	.81	.60	.87
English RC written (4)	.73	.63	.79
Total L1 RC (11)	.90	.86	.93
Total English RC (9)	.86	.76	.90

Notes: RC – reading comprehension. Items not attempted scored as zero for the purposes of the analysis.

3.7.1.6 Emergent writing – L1

Emergent writing was measured by asking participants to write out their full name on a lined page. The same scoring process was followed as in Wilsenach (2015). A total of two points were awarded, with one point awarded for the correct spelling of the first name and one point awarded for the correct spelling of the last name.

3.7.1.7 Spelling – L1 and English

Spelling was assessed as part of the individual sessions at t1 and t2, and in a group format at t3. For the individual sessions, the L1 words had similar word frequency in both languages and were spelled the same. First, participants were presented with a line drawing or black and white image, asked to identify the object the image represented (with corrective feedback), and then asked to write out the word in the particular language next to the line drawing. The task was not timed. In grade 1, the spelling of only one word was tested in L1 (*imoto ~ car*) and English (*dog*). These words used only one-letter graphemes for both vowels and consonants. At the start of grade 3, the grade 1 words were tested again so that growth in single word spelling could be observed. A word with a complex grapheme was added in all three languages. In L1 ***indl****ebe* (*ear*) was added, and *sheep* was added to the English spelling task.

Spelling was scored in two ways. The first method used dichotomous scoring (correct or incorrect, with provision for non-responses coded as NA) and represented participants' ability to spell completely correctly. The second scoring method, suggested by RTI International (2016) to get a wider distribution of scores and award partially correct answers, awarded a point to each correct letter sequence. This method of scoring allows the measurement of participants' partial knowledge of the orthographic representations of words. For example, <dog> scored in the second (partial scoring) method would be scored out of four, with one point for correctly starting with <_d>, one point for following the consonant with the correct vowel <do>, one point for following the vowel with the correct consonant <og>, and a final point for ending on the final consonant <g_>. For example, when <dog> was spelled <dogi> by participants (participant 111), they would receive zero for the dichotomous scoring. With the partial answer scoring, the participant would receive a score of three out of four. If the participants had written <idogi>, the score would drop to two out of four because of the vowel preceding <d> (participant 087). An example from isiZulu is a participant writing <imto> (participant 59) and leaving out the middle vowel of <imoto>. The participant would score zero for the dichotomous scoring but would receive four out of six for the partial scoring. Examples of scoring are presented in appendix A4 in section 9.4.

At t3, participants also completed spelling from dictation tasks in L1 and English. I used the isiXhosa spelling task from Daries and Probert (2020) with the following changes to ensure that the isiZulu task would be parallel: items 1 (*umuntu* – person), 7 (*ixesha* - time), 9 (*ngokwenene* – really) and 10 (*umakhulu* – grandmother) were removed because they had different spellings in isiZulu; item 3 (*lwakhe* – his) was changed to *yakhe* to reduce orthographic complexity and used for both groups; *imoto* and *indlebe* were added for both groups as these were the words used in the individual tests. The final L1 spelling test included 10 words. I used the 10 item English spelling task from Makaure (2021) and changed only item 4 (*laugh*) to *cough*. I replaced *laugh* as it is pronounced similarly to *love* in the accent of the other raters, and I wanted to reduce error introduced by pronunciation. Participants completed the test in a group format. After the task was explained, each word was said twice. Words were scored dichotomously (correct or incorrect). The sum score was used in later analysis. These tasks had acceptable internal consistency (*Table 3-7*).

Table 3-7. Internal consistency of the L1 and English end of grade 3 spelling task estimated using Cronbach's alpha

Task (Max Score)	All	isiXhosa	isiZulu
L1 Spelling (10)	.94	.94	.94
English Spelling (10)	.82	.76	.86

3.7.2 Phonological processing

Phonological processing (PA, PWM and RAN) in English was measured using the second edition of the Comprehensive Test of Phonological Processing (Wagner et al., 2013a) (CTOPP-2). Similar tasks were created for isiXhosa and isiZulu based on the CTOPP-2 but keeping the language characteristics in mind. The L1 tasks were piloted before use, and insights from the pilot study are included in these sections. The results of the pilot study are presented in section 3.9. Inter-rater reliability was calculated for the PA and PWM tasks and is presented in section 3.7.2.4.

3.7.2.1 Phonological awareness

3.7.2.1.1 English PA tasks

The blending, elision and isolation tasks from the CTOPP-2 (form for children aged 7 to 24) (Wagner et al., 2013a) were used to measure PA in English. Although some children were younger than 7 years, the sound matching task from the 4 – 6 form was not used. Firstly, it was important that a L1 task could be developed that was similar in task demands to the English tasks. It was possible to create blending and elision tasks for the L1 as has been done previously for isiXhosa (Diemer, 2016). However, the sound matching task is difficult to develop for isiXhosa and isiZulu because of the language structure. Almost all nouns start with a vowel that represents the noun class prefix, and end on a vowel (see section 3.6). While nouns are easy to represent in images (which are used with the sound matching task), it would only be possible to test the five vowels. Verbs in the imperative begin with consonants, but verbs are more difficult to visualise unambiguously, and mostly end with a vowel. A sound-matching task in isiXhosa and isiZulu would be able to test fewer representations than the English task. The second reason to use the elision task and not sound matching is to examine the rate of growth on the raw scores for the same task at the different time points.

The CTOPP-2 form for ages 7 to 24 tests PA at the syllable, onset and rime, and phoneme levels using elision, blending and isolation tasks. All items target real words, and all responses are real words, which the test developers explain helps young children understand the tasks (Wagner et al., 2013a). The elision task required participants to repeat a word after deleting part of the word. For example, 'Say "toothbrush". Now say "toothbrush" without "tooth". Answer = "brush" (Wagner et al., 2013c, p. 2). The task progressed in difficulty from elision of words (which are monosyllabic e.g., "tooth"), to singleton phonemes, to phonemes within a consonant cluster. The position of the elided phonological unit varied from initial, final and within word positions. The elision task contained 34 items in total.

The blending task required participants to blend the segments of a word together into a real word. The word segments were pre-recorded by the test developers and made available via a CD. The audio for each item was played through headphones to the testee. For example, 'What word do these sounds make /t/ /oɪ/ ?' Answer = "toy" (Wagner et al., 2013c, p. 5). The audio segments use an American accent, so some words were pronounced differently from the South African English accent used by the participants. For example, South African English is non-rhotic (does not pronounce syllable final <r>) so words like *number*, *answer,* and *hammer* sound different from the recordings. Nevertheless, children who were able to blend the words in general (i.e., also had high blending scores in L1) were able to blend these items, albeit with an American accent. The blending task increased in difficulty level from blending words, to syllables, onset and rime, and phonemes. The task included 33 items.

The isolation task required participants to isolate a phoneme at a particular part of a word. For example, 'The word *man* has three sounds, /m/-/a/-/n/, *man*. What is the first sound – the one in the beginning – in the word *man*? Answer = /m/' (Wagner et al., 2013c, p. 6). The task increased in difficulty with isolation of the initial, final, and middle points of three phoneme words, to isolation of phonemes within a consonant cluster, as well as the isolation of sounds that are not represented in the orthography (e.g., fourth sound of *waves* ~ /z/ (Wagner et al., 2013c, p. 7). The task included 32 items.

The blending task was administered first, followed by the elision and isolation tasks. During the first 14 items of the elision task, the participant was provided with corrective feedback. The first four items, and items nine to twelve of the blending task included corrective feedback. The first four items, and items 17 to 23 of the isolation task included corrective feedback. The tasks were discontinued after three consecutive errors, as per the test manual. One point was awarded for a correct answer. Incorrect responses received zero and non-responses were scored as NA. Both tasks were completed orally with no supporting pictures or charts. The tasks had high internal consistency in the current sample (*Table 3-8*).

Table 3-8. Internal consistency of the English PA tasks in the study sample

	All		isiXhosa		isiZulu	
Task (Max Score)	**T1**	**T2**	**T1**	**T2**	**T1**	**T2**
Total (99)	.95	.97	.96	.96	.95	.97
Elision (34)	.89	.93	.91	.92	.88	.95
Blending (33)	.89	.93	.89	.94	.87	.93
Isolation (32)	.92	.93	.92	.91	.92	.94

Notes: T1 – end grade 1; T2 – start of grade 3

3.7.2.1.2 L1 PA tasks

The L1 PA tasks were modelled after the CTOPP-2 (Wagner et al., 2013a) English PA tasks. The differences between the language structures of English and isiXhosa/isiZulu meant that only open syllables and singleton phonemes were targeted in L1. It was important to ensure that the PA tests were as similar as possible between isiXhosa and isiZulu so that any differences in group scores could be attributed to individual differences in children's performance and not to the test.

The similarity between the CTOPP-2 and the L1 versions was ensured by using the same (translated) instructions, including example items with corrective feedback, and following a simpler to more difficult progression in each task. The instructions were translated by professional translators, and then updated by the research assistants after the pilot study to make sure the instructions used language that the children understood. The easy to more difficult progression was followed by placing the syllable items before the phoneme items, and shorter words before longer words within each task. Additionally, the blending task prompts were audio recorded to reduce variability in the way the syllables and phonemes were presented, as was done in the CTOPP-2. Both verbs and nouns were used in L1 since they can stand alone without affixes. An item bank which included words with similar frequency, meaning and spelling in isiXhosa and isiZulu was created from two bilingual school dictionaries (Oxford Bilingual School Dictionary: isiZulu and English (de Schryver, 2014) and the Oxford Bilingual School Dictionary: isiXhosa and English (de Schryver & Reynolds, 2014). The word bank was used to find stimuli that were as equivalent as possible in both isiXhosa and isiZulu. The word bank also specified the part of speech, and number of syllables in each word.

I had not previously assessed grade 1 children on PA in isiXhosa and isiZulu so it was necessary to pilot more items than was needed so that the best items could be retained for the final test. For this reason, two forms of the pilot test were created (Version A and Version B) so that more items could be piloted. Half the pilot participants received Version A and the other half received Version B in each language. This resulted in four pilot assessments: isiXhosa Version A, isiXhosa Version B, isiZulu Version A and isiZulu Version B. Each version included elision, blending and isolation tasks. The elision and blending tasks targeted both syllables and phonemes and the isolation task targeted only phonemes. Items from the pilot study which contributed to greater reliability in the test were retained for the final test which resulted in one isiXhosa and one isiZulu form. The pilot study is addressed in more detail in section 3.9.

The final isiXhosa and isiZulu PA tests included blending, elision, and isolation tasks. All tasks began with two examples with corrective feedback provided. Example items were not scored. The tests were carefully designed to ensure progression in item difficulty, as well as similarity between the isiXhosa and isiZulu versions. There was no discontinuation rule since it was not possible to determine with confidence at which point the test should be discontinued based on the pilot results. Participants were therefore required to complete the entire test.

The blending task included four syllable blending items (e.g., *i-bha-na-na* (X); *u-bha-na-na* (Z); banana) and six phoneme blending items (e.g., *i-j-e-z-i* (X and Z), jersey). The syllable elision items were three and four syllables long. The phoneme elision items were one to three syllables long (two to five phonemes). Recordings of the syllable and phoneme segments were completed by an isiXhosa and an isiZulu speaking research assistant who also administered the tasks. Both speakers were between the ages of 22 and 26, female, and first language speakers of the language. The segments were recorded using Audacity® version 2.3.1 (Audacity Team, 2019), and edited so that a .4 second pause was included between each segment. Because students did not seem to follow the recordings easily in t1, the blending task items were enunciated by the tester at t2 after training.

The elision task included six syllable elision items (e.g., *isifo* without *fo* is *isi*) and four phoneme elision (e.g., *bona* without *b* is *ona*) items. The syllable elision items were three syllables long. The first, middle and last syllable were targeted in two items each. The phoneme elision items were four to five phonemes long and targeted initial phonemes only. One item was a noun requiring deletion of a vowel (noun class prefix) and the other three were verbs and required deletion of the initial consonant. The language structures of isiXhosa and isiZulu mean that the final answer for each prompt does not result in a real word. This means that this feature of the test is different from the English version which has a real word stimulus and answer. Nevertheless, given the low English vocabulary of participants, it is likely that participants were unaware that the answers in English are real words, thereby making this difference between languages a non-issue.

The isolation task included five items varying in length from two to five phonemes. The task required identification of a phoneme in different parts of the words including initial, final, middle and second position (e.g., last sound of *ona* is *a*). As per earlier items in the isolation task of CTOPP-2, the instructions explicitly mention how many sounds are in the word before asking the participant to identify a phoneme in a certain position in the word. The isiXhosa and isiZulu PA task included 25 items in total. The internal consistency of the test and sub-tasks is presented in *Table 3-9*. The reliability of the isolation task is low given the few items in the task. Cronbach's alpha is sensitive to number of items, often with tests with more items being more consistent than tests with fewer items. The reliability for the isolation task is lower for the isiXhosa group, which could also be due to background noise at the school. Nevertheless, as a whole, the PA test is reliable, and reliability increased from t1 (end of grade 1) to t2 (start of grade 3).

Table 3-9. Internal consistency of L1 PA tasks estimated using Cronbach's alpha

	All		isiXhosa		isiZulu	
Task (Max Score)	**T1**	**T2**	**T1**	**T2**	**T1**	**T2**
Total (25)	.84	.90	.83	.88	.85	.92
Elision (10)	.79	.83	.79	.81	.79	.86
Blending (10)	.69	.80	.73	.77	.64	.82
Isolation (5)	.49	.64	.40	.50	.59	.74

Notes: T1 – end of grade 1; T2 – start of grade 3

3.7.2.2 Phonological working memory

3.7.2.2.1 English PWM tasks

PWM was assessed using the Memory for Digits and NWR tasks of the CTOPP-2 (Wagner et al., 2013a). Both tasks were completed orally with no supporting pictures or charts. The Memory for Digits task is a forward digit span task. Participants were presented with audio recordings of digits one to nine in English and had to repeat them in the same order (e.g., the recording says *5 [pause] 2* and the participant should repeat the sequence in the same order: *5 [pause] 2* (Wagner et al., 2013c, p. 8)). Digit sequences increased in difficulty from two digits to nine digits in length. The task included 29 items. The participants were provided with corrective feedback for the first four items. From item five, each digit span sequence was included three times (i.e., three trials of three digits in sequence, three trials of four digits in sequence, etc.). The test manual administration instructions were followed: trials were not replayed (even when requested), a point was awarded only when digits were repeated in the correct order (no partial points), and the task was discontinued after three consecutive errors. The test manual indicates that the task has high reliability (Cronbach's alpha above .74) for age groups 4 to 25 (Wagner et al., 2013a). The test was also reliable for the current sample at each time point (Table *3-10*).

In the NWR task, participants were instructed that they would hear made up words and would have to repeat them to the research assistant. The made-up words sounded like English words but were not real words (e.g., *teeg* /ti:g/ (Wagner et al., 2013c, p. 10)). The words varied in length from one to nine syllables. The task progressed in difficulty from shorter to longer words. The task was administered in accordance with the test manual: the audio recordings from the test developer were used and participants listened to the words using headphones, trials were not repeated, a point was awarded only when all segments of the word were said correctly and in the same order as the recording, and the task was discontinued after three consecutive errors. The test manual indicates that the task has acceptable reliability (Cronbach's alpha .7 or higher) for age groups 4 to 25 (Wagner et al., 2013a). This level of internal consistency was also achieved in the current sample at both time points when the entire sample was considered (Table *3-10*). However, the internal consistency of the NWR task was below .7 for NWR at both time points and in both language groups, except for isiXhosa t2 where α = .83. Many of the reliability values in the group analysis were below the median value of .82 reported for L2 research (Plonsky & Derrick, 2016). Multiple factors could affect the internal consistency including background noise which interferes with what the participants could hear on the headphones, and/or differences in accent between the isiXhosa and isiZulu research assistants and the American accent recording. These two reasons are discussed in more detail in section 3.7.2.2.4. The lower reliability may also be because the sample has low proficiency in English as Plonsky and Derrick (2016) found that lower reliability was reported in samples with lower language proficiency.

Table 3-10. Internal consistency of English PWM tasks for the current sample estimated using Cronbach's alpha

	All		**isiXhosa**		**isiZulu**	
Task (Max Score)	**T1**	**T2**	**T1**	**T2**	**T1**	**T2**
Digit Span (28)	.76	.86	.75	.81	.77	.89
Nonword Repetition (30)	.71	.77	.65	.83	.68	.64

Notes: T1 – end of grade 1; T2 – start of grade 3

3.7.2.2.2 L1 PWM tasks

The L1 tasks were modelled after the CTOPP-2 (Wagner et al., 2013a). Both tasks were piloted and revised before their use in the main study. The pilot and final tests for digit span and NWR are addressed in this section.

The digit span task in isiXhosa and isiZulu contained two-to-six-digit sequences of digits one to six since these digits have the same number of syllables in both languages. The isiXhosa and isiZulu digits are phonologically similar for digits one to five. Digit six (X: *zintandathu*; Z: *isithupha*) differs phonologically between the languages but both terms have four syllables. Thereafter, the digits differ in the number of syllables per word. It was important for the isiXhosa and isiZulu digit span task to be as equivalent as possible (even in terms of syllables per answer) so that any differences in scores could be attributed to the groups and not to the test. The test items for the pilot and main study remained the same with three trials per digit sequence length (i.e., three trials of two-digit sequences, three trials of three-digit sequences etc.) for a total of 15 trials, with two unscored examples. Audio recordings of trials were presented using headphones. Recordings of the digits were completed by an isiXhosa and an isiZulu speaking research assistant (females between the ages of 22 and 26 and first language speakers of the language) who also administered the tasks at t1. The assistants were recorded saying each digit five times. Audacity® version 2.3.1 (Audacity Team, 2019) was used to cut the best representation of each digit. These segments were combined to create the series with .4 seconds pause at the start of the sequence, and .25 seconds pause between each number for the final test[22]. Each item was saved as a separate recording. The test manual administration instructions from the CTOPP-2 Memory for Digits task were followed.

One NWR task was created for use with both isiXhosa and isiZulu using sounds that occur in both languages. Syllables were combined to create three (e.g., *yemodo /jemodo/*) to eight (e.g., *kolohlawezatasafi /koloławezatasafi/*) syllable nonwords. A consonant-vowel format was used to mimic the canonical syllable structure of isiXhosa and isiZulu. In the pilot study, four nonwords per syllable length were presented, resulting in a total of 24 items. The best performing items were retained for the final test which included three nonwords per syllable length (total of 18), with two unscored examples. The nonwords were recorded by a female isiXhosa first language speaker aged 24. The speaker said the words with real word intonation which included penultimate syllable lengthening. The best representation of each word was selected using Audacity® version 2.3.1 (Audacity Team, 2019) and saved as a separate file. The same recordings were used for the isiXhosa and isiZulu groups so as not to introduce additional variance from slightly different enunciation of each nonword by a different speaker. The task was administered in the same way as the CTOPP-2 NWR task.

[22] In the pilot study, the pause between digits was 1.25 seconds long. The pause was unnecessarily long and was corrected to .25 seconds for the final version of the task.

At both time points, the internal consistency of the digit span task was below .7 and the internal consistency of the NWR task ranged from .71 - .80 (*Table 3-11*). There are a few reasons why the digit span task and NWR were less reliable than other tasks. The lower reliability for the digit span task may be due to the reduced items since items which were all answered correctly (i.e., initial items) and incorrectly (i.e., later items) are not included in the Cronbach's alpha calculation. The participants' knowledge of digits in their L1 did not seem to be automatic. Finally, something which may have affected both tasks is the loud background noise at the school which could have interfered with what the participants could hear on the headphones.

Table 3-11. Internal consistency of L1 PWM tasks for the current sample estimated using Cronbach's alpha

	All		**isiXhosa**		**isiZulu**	
Task (Max Score)	**T1**	**T2**	**T1**	**T2**	**T1**	**T2**
Digit Span (15)	.66	.67	.67	.77	.67	.63
Nonword Repetition (18)	.73	.78	.75	.76	.71	.80

Notes: T1 – end of grade 1; T2 – start of grade 3

3.7.2.3 *Rapid automatised naming*

Alphanumeric (letters and digits) and non-alphanumeric (objects and colours) RAN naming tasks were used. Letter naming was assessed only in L1 since the letter sounds are very similar in L1 and English. Digit naming and colour naming were assessed only in English since the pilot study showed that these categories were more likely to be known in English and less likely known in L1. Object naming was assessed in both languages, using a different chart for L1 and English.

3.7.2.3.1 English RAN tasks

Rapid naming of colours and objects was assessed in English using the CTOPP-2 form for ages 4 to 6 (Wagner et al., 2013b). Rapid naming of digits was assessed using the CTOPP-2 form for ages 7 to 24 (Wagner et al., 2013b). Although the participants were mostly older than 6 years of age, non-alphanumeric RAN tasks were included to get a broader understanding of participants' rapid naming abilities over time. The non-alphanumeric RAN tasks were also included since some participants would not yet know letters and numbers automatically. Participants were required to name six colours (*black, blue, brown, green, red,* and *yellow*), six objects (*chair, boat, fish, key, pencil,* and *star*) and six digits (*2, 3, 4, 5, 7,* and *8*) in English presented on a 9 by 4 chart in semi-random order as fast as they could.

Participants first completed a practice trial where their knowledge of the colours, objects and digits in English was checked. Participants who made errors completing the practice items received corrective feedback. If more than two items were consistently still named incorrectly after receiving corrective feedback, the task was not administered. The timer was started when the participant named the first item, and the timer was stopped when they completed naming the last item. The total time taken to name all items was recorded. Any errors made were indicated on the score sheet. Test-retest reliability from the test manual indicates correlations of .85 or higher (Wagner et al., 2013a).

3.7.2.3.2 L1 RAN tasks

Rapid naming of letters and objects was assessed in L1 using the RAN tasks from the EGRS 2 (Department of Basic Education, 2018). While it would have been possible to use the letter naming task from the CTOPP-2 to assess letter naming, the EGRS II tasks were used to enable comparison of the results with a similar sample of participants from South Africa. The EGRS 2 RAN tasks[23] were administered in the same way as the English RAN tasks. Participants were required to name six letters (*a, b, e, l, o,* and *t*), and six objects (*book, dog, hand, star, sun,* and *table*) presented on a 9 by 4 chart in semi-random order as fast as they could. *Table 3-12* presents the labels for the objects in each language. The administration procedures were the same as the English tasks.

RAN tasks have not been used extensively in the South African context. There is, however, test-retest reliability data available for the rapid letter naming task used in the EGRS 2. Immediate administration of the same rapid letter naming form with the isiZulu grade 3 sample of the EGRS 2 demonstrated acceptable reliability (r = .81, 95%CI [.72; .87], N = 87, *own calculations;* Department of Basic Education & University of the Witwatersrand, 2020).

Table 3-12. Object labels in each language for the L1 rapid object naming task

English	isiXhosa	isiZulu
Sun	ilanga	ilanga
Dog	inja	inja
Table	itafile	itafula
Star	inkwenkwezi	inkanyezi
Hand	isandla	isandla
book	incwadi	ibhuku

3.7.2.4 Inter-rater reliability of the PA and PWM tasks

Inter-rater reliability was calculated for the tasks that I did not administer (i.e., PA, digit span, and NWR tasks) to determine the consistency of scoring, by raters in each context. These tasks were administered by two research assistants in each language, so it was important to determine that the scoring was undertaken according to the

[23] In the EGRS II the total number of items named correctly in 20 seconds was recorded, and the score converted to an items correct per second score. In the present study, the test administration of the CTOPP-2 was followed to ensure comparability across languages within the current study.

training and task instructions. For each language group, the PA tasks were administered by one research assistant in both the L1, and English and the PWM tasks were administered by one research assistant in both the L1 and English. All research assistant sessions were recorded. I checked the recordings of 20% of the sample for each language group (n = 15) for scoring consistency.

In determining the reliability of the scores, the assistant scores (captured during the assessments) were compared to the researcher scores (captured after listening to session recordings). The reliability of the scoring was decided based on the extent to which there is agreement between the scorers, and where there are differences, to determine the consistency with which the scorers differ. However, because the same tasks were scored by the same research assistants, absolute agreement between scorers is not as important as consistent scoring. Thus, it would be unproblematic for the scores to differ by two points, for example, as long as the assistant scored items consistently.

3.7.2.4.1 Grade 1 inter-rater reliability

Descriptive statistics for the variables measured in grade 1 are reported in *Table 3-13*. *Table 3-13* shows that the assistant scores were statistically no different from the researcher scores in all cases except for English NWR. My raw scores on English NWR were lower by 1.2 ($t(14) = 2.942$, $p = .011$), and 2.8 points for the isiXhosa and isiZulu ($t(14) = 7.122$, $p = <.001$) groups. Nevertheless, all variables were consistently scored by the assistants for both isiXhosa and isiZulu. All inter-rater correlations (Spearman's rho: .75– .98; Pearson's r: .82 – 1.00) were above the .7 minimum for inter-rater reliability (Multon, 2012).

My score for English NWR may have been lower than the scorers for two reasons. The English NWR task had the lowest inter-rater reliability of the tasks, possibly also due to the larger difference in absolute score agreement. The lower absolute agreement and reliability in this task can be explained by extrinsic variables not related to the assessments. For example, although the research team worked in an empty classroom (isiXhosa school) or an unoccupied staff room (isiZulu schools), the research environment was extremely noisy (especially in the isiXhosa school). I was able to replay the recording so I could hear the learner's response better, but the assistants would not have been able to do this. At the same time however, this does not explain why the L1 NWR test (which is a similar task) is more reliable. I speculate that the lower reliability of the English NWR task (although acceptable) can be attributed to the background noise making it more difficult for the assistants to discern the sounds (vowels especially) in the nonwords. The assistants are additional language speakers of English and accepted accented responses. For example, isiXhosa and isiZulu have five vowel phonemes, but when learning English, speakers of these languages must learn to discern and pronounce the 22 vowel phonemes of English. When scoring 20% of the sample, I realized that the assistants were more lenient in their scoring either because they discerned the vowel as correct, or because they gave the learner the benefit of the doubt because they have not 'heard' English enough yet. For example, nonwords which contained schwa (such as item 5 *zid,* pronounced /zəd/ on the accompanying CD) resulted in different scores between the assistant and researchers. The learners substituted the schwa with the closest sounding vowel which resulted in answers which ranged from the extremes of /zi:d/, /zɐd/ and /zed/ and answers which more closely sounded like schwa. All these responses were scored as "correct" by the assistants most of the time. Another example of English vowels being substituted for the closest sounding isiXhosa and isiZulu vowel is item 16 (*voesutoov*, pronounced /vœʊzətuːv/ on the accompanying CD). Since there are no diphthongs in isiXhosa and isiZulu, most learners responded with /vʉ:zetuːv/ which was marked as "correct" by both the isiZulu and isiXhosa assistants.

I decided not to re-score all participants on the English NWR task because (1) the tasks were consistently scored by both assistants (Pearson's r and rho above .7), (2) both assistants scored the vowel sounds in a similar way (thus on average getting larger final scores than the researcher), and (3) an English additional language assistant was going to administer and score the assessment in the next timepoint. Thus, although the assistants scored more of the answers as correct than I did (possibly due to noisy conditions, and English additional language background) this was done consistently, and similar scoring will mostly likely occur in the future data collection time points. I therefore concluded that the scores on the English NWR task were acceptably reliable not to warrant rescoring all the learners.

Table 3-13. Comparison between assistant and researcher scores for the grade 1 assessments for the inter-rater reliability analysis

	Assistant				Researcher				Welch's t test			Correlation	
	M	**SD**	**Min**	**Max**	**M**	**SD**	**Min**	**Max**	**Mean diff**	**t**	**p**	**rho**	**r**
isiXhosa (N = 15)													
L1 PA[a]	7.4	4.5	2	19	7.4	4.9	1	21	0.00	0.00	1.00	.89**	.92**
L1 Digit Span[b]	5.1	2.8	0	8	5.0	2.7	0	8	0.13	-1.47	.16	.98**	.99**
L1 NWR[b]	6.9	2.8	1	11	7.2	2.9	1	11	-0.33	0.86	.40	.81**	.87**
Eng PA[a]	19.8	12.4	0	46	20.1	13.1	0	48	-0.30	0.54	.60	.98**	.89**
Eng Digit Span[b]	14.1	1.8	11	17	13.9	1.9	10	17	0.20	-1.47	.16	.97**	.98**
Eng NWR[b]	15.3	2.8	10	20	14.1	2.8	9	18	1.20	-2.94	**.01**	.75**	.82**
isiZulu (N = 15)													
L1 PA[c]	6.9	5.5	1	20	6.4	6.0	1	21	0.47	-0.81	.43	.79**	.93**
L1 Digit Span[d]	5.0	1.9	2	7	4.7	1.8	2	7	0.27	-1.74	.10	.94**	.95**
L1 NWR[d]	6.0	2.8	2	11	5.9	2.8	2	12	0.07	-0.17	.87	.91**	.85**
Eng PA[c]	17.0	15.4	1	51	17.3	17.4	1	54	-0.30	0.29	.77	.96**	.98**
Eng Digit Span[d]	13.5	2.8	9	19	13.5	2.9	9	19	0.00	-1.00	.33	1.0**	1.0**
Eng NWR[d]	14.7	2.3	8	18	11.9	2.7	6	16	2.80	-7.12	**<.001**	.78**	.83**

Notes: * $p < .05$; ** $p < .01$; *** $p < .001$; IRR – inter-rater reliability; M – mean; SD = standard deviation; Min – minimum; Max – maximum; Mean diff – mean difference between raters; PA – phonological awareness; NWR – nonword repetition; The superscript letters represent different scorers.

3.7.2.4.2 Start of grade 3 inter-rater reliability

Descriptive statistics for the PA, digit span and NWR variables measured at the start of grade 3 are reported in *Table 3-14*. Different scorers were trained for grade 3. The results in *Table 3-14* demonstrate that the assistant and researcher scores were similar, differing by less than 0.8 in the raw scores. I had similar scores to the assistants for all tasks expect for L1 NWR (1.0 point difference, t(14) = 3.29, p = .01) and English NWR (-2.8 points difference, t(14) = -3.33, p = .005) for the isiXhosa group. The correlation between the research and assistant scores were high for all variables when using either Spearman's rho or Pearson's r. However, the correlation between the English NWR scores for the isiZulu group was very low (r = .31, rho = .28).

The NWR tasks, again had lower reliability than the other tasks, as was seen in grade 1. This task may generally be more difficult to score consistently than the other tasks. Any background noise makes it very difficult to hear participant responses, and I observed that many children spoke very softly, even when prompted to speak up. This meant it was difficult to hear, even on the recording (especially in the isiXhosa school which had more/louder background noise). Another reason why the correlation between English NWR scores was so low for isiZulu is that the range of scores was much narrower than for the isiXhosa sample. This could result in a flatter slope (*Figure 3-1*).

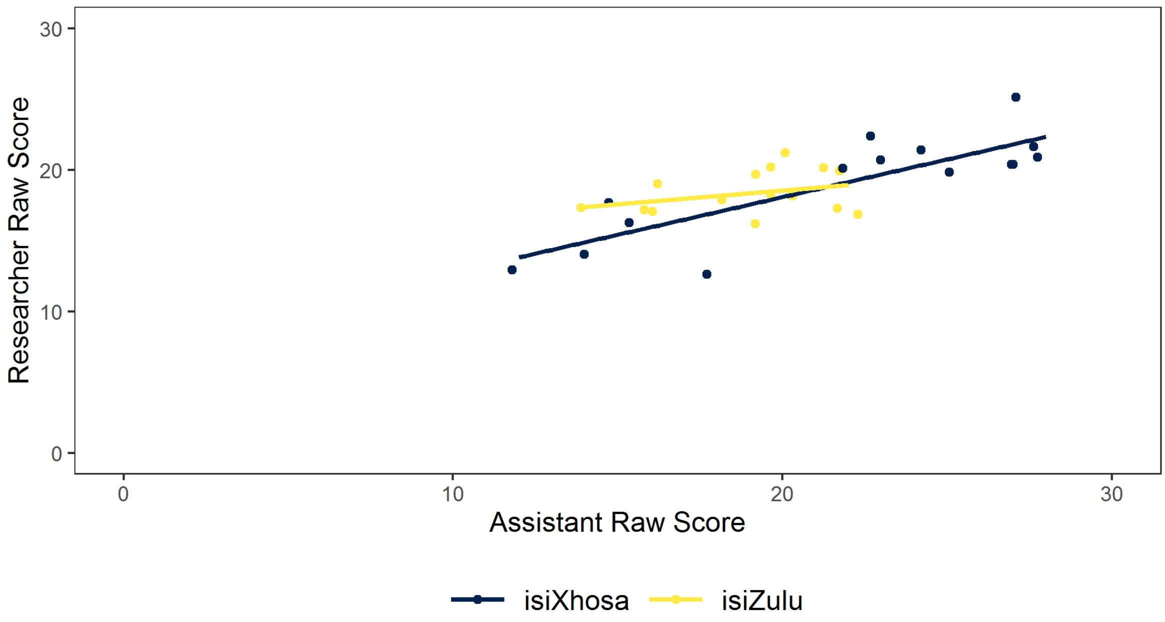

Figure 3-1. Scatterplot comparing assistant and researcher raw scores on English NWR at t3

Table 3-14. Comparison between assistant and researcher scores for the grade 3 assessments for the inter-rater reliability analysis

	Assistant				Researcher				Welch's t test			Correlation	
	M	**SD**	**Min**	**Max**	**M**	**SD**	**Min**	**Max**	**Mean diff**	**t**	**p**	**rho**	**r**
isiXhosa (N = 15)													
L1 PA[a]	15.3	4.7	7	22	15.1	4.9	7	22	0.2	-1.00	.33	1.00***	0.99***
L1 Digit Span[b]	7.5	2.6	4	15	7.3	2.5	4	15	0.2	-1.00	.33	0.95***	0.98***
L1 NWR[b]	6.5	3.1	0	12	7.5	3.1	0	13	-1.0	3.29	**.01**	0.88***	0.94***
Eng PA[a]	34.3	16.7	8	67	34.6	16.6	10	64	-0.3	0.37	.72	0.99***	0.99***
Eng Digit Span[b]	16.3	2.9	12	21	16.3	2.9	12	21	0.0	-1.00	.33	1.00***	1.00***
Eng NWR[b]	21.9	5.6	12	28	19.1	3.6	13	25	2.8	-3.33	**.005**	0.75**	0.84***
isiZulu (N = 15)													
L1 PA[a]	13.4	6.4	5	24	13.4	6.3	5	23	0.0	0.00	1.0	0.97***	0.99***
L1 Digit Span[b]	6.1	3.7	0	14	5.9	3.5	0	14	0.2	-1.17	.26	0.96***	0.97***
L1 NWR[b]	8.5	4	0	13	8.4	3.6	0	12	0.1	-0.4	.70	0.86***	0.95***
Eng PA[a]	36.9	19.1	3	70	37.5	19.9	4	70	-0.6	1.19	.26	0.99***	1.00***
Eng Digit Span[b]	17.5	4.7	11	27	17.3	4.5	11	26	0.2	-1.87	.08	0.99***	1.00***
Eng NWR[b]	19	2.5	14	22	18.3	1.5	16	21	0.7	-1.03	.32	0.28	0.31

Notes: * p < .05; ** p < .01; *** p < .001; IRR – inter-rater reliability; M – mean; SD = standard deviation; Min – minimum; Max – maximum; Mean diff – mean difference between raters; PA – phonological awareness; NWR – nonword repetition; The superscript letters represent different scorers.

3.7.3 Receptive vocabulary

The Peabody Picture Vocabulary Test Fourth Edition[24] (PPVT-IV; Dunn & Dunn, 2007) was used to measure participants' receptive vocabulary. The test is widely used in South Africa by practicing speech and language therapists for English and African language assessment (van Dulm & Southwood, 2014). The PPVT-IV has also been used for research purposes with participants in similar contexts as the participants in the current study (e.g., Biersteker & Dawes, 2019; Wilsenach, 2015). The PPVT-IV is not available in African languages, so practitioners and researchers translate and adapt the test for the African languages. I have also done this.

3.7.3.1 English receptive vocabulary

English receptive vocabulary was assessed using Form B of the PPVT-IV without changes or adaptations to target words or images. The reliability (internal consistency) of the test in the current sample administered mid-grade 1 estimated using Cronbach's alpha was .93 for the isiXhosa group, .94 for the isiZulu group, and .94 for the whole sample. I provide a summary below of how the test was administered.

The test session began with the tester establishing rapport with the participant. The tester then explained how the test works, then worked through two age-appropriate examples. For each target word, participants were presented with four pictures and asked to identify the picture that corresponded to the target word. The picture could be identified by pointing to it, or by saying the number (1 – 4) under each picture. The tester noted the participant's response on the score form, and whether the answer was correct or not. Except for the training items, the tester did not indicate whether the participant's answers were correct or not. I deviated from the standardised administration procedures (described below). In my study, all participants began at item 1 to ensure consistency with the L1 test (i.e., a basal set was not established). However, the test was stopped at the ceiling set (see below).

The standardised administration procedures are presented below. The basal and ceiling sets were not used. The test items are grouped into sets of 12 items which became increasingly more difficult. The test manual indicates that participants should start on the item appropriate for their age to limit testing time. For example, set five includes the start item for children six years old. If one or fewer errors are made in this initial set, the set becomes the basal set. If more than one item is incorrect, the tester should go back a set until the participant makes one or no mistakes. The set where one or zero mistakes are made is termed the basal set. Thereafter, the test should progress

[24] The fifth edition of the PPVT was released in 2018, and boasts updated normative data, updated items to suit Canadian participants, and a simpler administration process. I only have access to the PPVT-IV, and since the normative data will not be used, and the test was administered in entirety, it is deemed unproblematic to use the earlier edition in the current study.

in increasing set numbers. Participants need to correctly identify at least five items to move on to the next set. Once eight or more errors are made in a set, that set becomes the ceiling set and the last item in the ceiling set is termed the ceiling item. The test manual indicates that participants who make more than seven errors in set one should not continue with the test as they have a chance level score.

The raw score is calculated by subtracting the total number of errors from the ceiling item. This scoring method awards credit to all items before the basal set, and no credit for items after the ceiling item. The raw score can be converted to standard scores, percentiles, normal curve equivalents, as well as grade and age equivalents. The test manual indicates that normative scores should not be used for people who are not proficient in English since the norm sample was based only on people who have English proficiency.

3.7.3.2 L1 receptive vocabulary

Form A of the PPVT-IV was translated into isiXhosa and isiZulu using bilingual dictionaries and the help of a translator. During the translation activities, it became apparent that adaptation of some items was also necessary to ensure that the assessment was appropriate for the languages and context. Before the pilot study, the first nine sets (108 items) of Form A of the PPVT-IV were translated into isiXhosa and isiZulu. After the completion of the pilot for the isiZulu version, children's scores indicated the need for a longer test so two more sets were translated (sets 10 and 11) and piloted in the isiXhosa pilot. When translating the items, it was noted if the word was not available in isiXhosa and isiZulu, was multiword or was not used by children, and notes on the appropriacy of the target and distractor pictures was also noted. Where available, the word frequency data was captured for the first 72 items[25] to determine if there was equivalence between the isiXhosa and isiZulu items. These notes were reviewed to identify where changes to the items was needed to make sure the test was linguistically and contextually appropriate.

Three types of changes were made to items including: (1) replacing the target picture with a contextually more appropriate picture to better match the lexical item e.g., *wooden fence* replaced by *wire fence*, (2) replacing distractor pictures to avoid confusion with the target lexical item e.g., replacing *waffle* with a slice of *cake*, and (3) using a distractor picture as the target lexical item instead of the original target lexical item e.g., using *full* instead of *empty*. Appendix A5 in section 9.5 provides a list of the items which were adapted.

[25] After this point, the words were difficult to find in the dictionaries which had frequency data available. The word frequencies were similar for isiXhosa and isiZulu, so it was deemed unnecessary to continue finding this information for the other items.

The final isiXhosa and isiZulu tests included 132 items. The same items were included in both languages except for item 130 which remained in the isiZulu test but was replaced with item 135 in the isiXhosa test due to the unavailability of a specific L1 word for *antlers*. The L1 form was administered in the same way as the English form. The internal reliability estimated using Cronbach's alpha for isiXhosa and isiZulu was .94 for each group, and for the whole sample was .95 in grade 1.

3.7.4 Home background survey

A short telephonic survey was created to record information about the participant's home background. The telephonic survey was conducted with the main caregiver as indicated on the 2021 consent form and took approximately 15 minutes to complete. Parents could choose to complete the interview in isiXhosa, isiZulu, or English. The assessor recorded the parents' answers in a Microsoft Form online.

The survey confirmed the demographic information of the child according to the school records and included questions on socioeconomic status, and language and literacy environment. Questions about socioeconomic status were used from the questionnaire in the EGRS 2 (Department of Basic Education, 2019b). These included questions on respondent's highest level of education achieved, number of assets from an asset list, and respondents' occupation. SES has often been linked to educational outcomes. Questions were asked about the home language environment to determine the respondent's and child's exposure to and use of various languages at home, school and in the community (e.g., *How often does this child hear these languages in the community?*). Some of these questions were informed by the Language History Questionnaire (Li et al., 2014, 2020). These questions were included to determine the level of multilingualism the children are exposed to, as my own observation was that the provinces differed notably in language use, which could affect scores on the tests.

Questions about the home literacy environment were included to determine the extent to which reading behaviours and materials were present in the home and community. Questions such as "Is there a library in your community?" and "How often does your child read to you in [language]?" were asked. The home literacy environment can play a role in children's educational outcomes. A recent review of evidence in low and middle income countries found that literacy materials available in the home were a moderate predictor of literacy outcomes (Zuilkowski, McCoy, et al., 2019).

3.8 PROCEDURES

In this section I detail the procedures used to collect data, clean, and process the data and to analyse the data.

3.8.1 Data collection procedures

Data collection took place over three years from 2019 – 2021. Data were collected in year one (2019) and twice in year three (2021). *Figure 3-2*, below, presents which months data were collected. School closures due to school holidays and COVID-19 lockdowns are represented in light grey and dark grey, respectively.

Data collection took place during school hours, as arranged with the principals, heads of department and teachers. For all sessions, the researcher and research assistants were responsible for collecting participants from their classrooms to ensure that the correct learners were selected. Additionally, we ensured that teachers agreed to release the participants for the test session. Participants were released from the test session for meals, and break times. Participants were also not kept after school to ensure they caught their transport home or had a group of friends to walk home with.

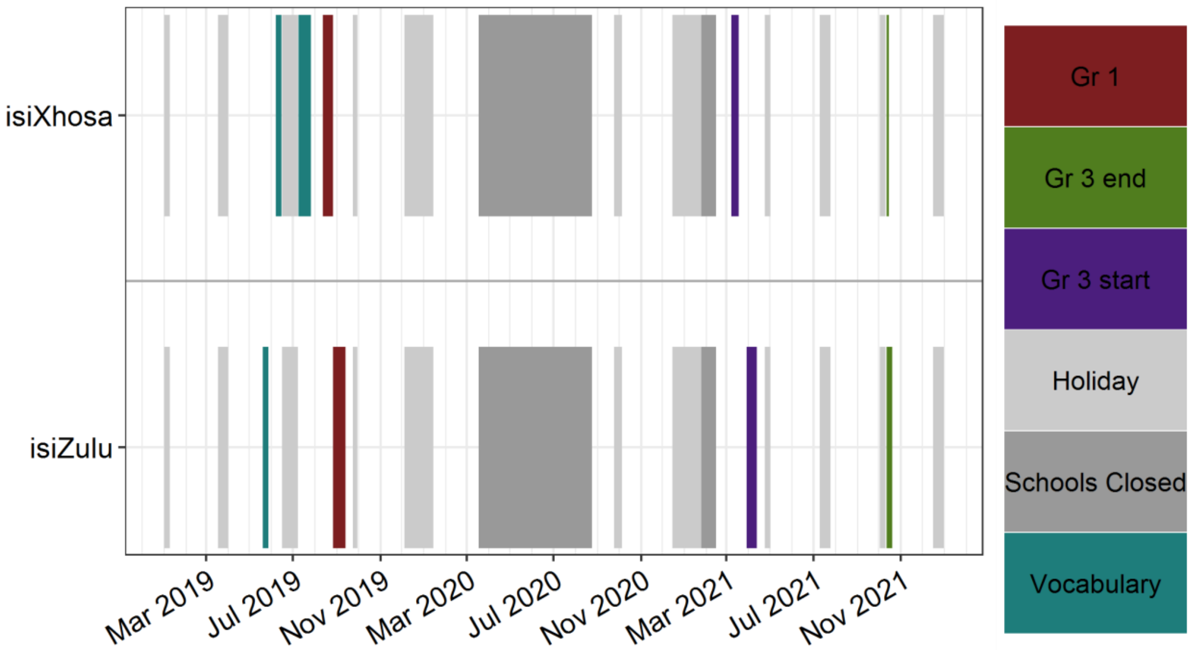

Figure 3-2. Data collection timeline

The vocabulary tests were administered in the staff room at school Z1 and X1, and in a storeroom at school Z2. A research assistant (L1) and the researcher (English) administered the vocabulary tests. After the instructions were explained in L1, half the participants began with the English test and half began with the L1 test. Scores were recorded on the paper-based score sheets. In total, the vocabulary test session lasted 15 minutes.

The phonological processing and literacy assessments were administered to children individually by a team of three researchers who were each responsible for different sections of the assessments. The data collection procedures are presented in *Figure* 3-3. One research assistant was responsible for the PA tasks, one was responsible for the PWM tasks, and I was responsible for the literacy and RAN tasks. Each section took approximately 10 minutes to administer, so children were in one session for 30 minutes total at a time. Participants completed the L1 session before the English session on different days which ensured participants understood the nature of the tasks. The break between language sessions was anywhere from two days to one week. I aimed to administer the L1 test to all participants before beginning the English assessments. Thus, at schools with fewer participants or where participants were absent until the final days of data collection, the gap was at minimum one day between the two assessments, and at schools with more participants, the gap was up to one week. In total, participants spent one hour completing phonological processing and literacy tasks in both languages at t1 and t2. Only literacy tasks were administered in t3. The individual testing lasted about 15 minutes and the group testing lasted up to one hour. The assessments were administered in the staff rooms at schools Z1 and Z2 at t1 and t2, and in a classroom (Z2) and storeroom turned (unused) COVID-19 sick bay (Z1) at t3. The assessments were administered in an empty classroom at school X1 at t1 – t3.

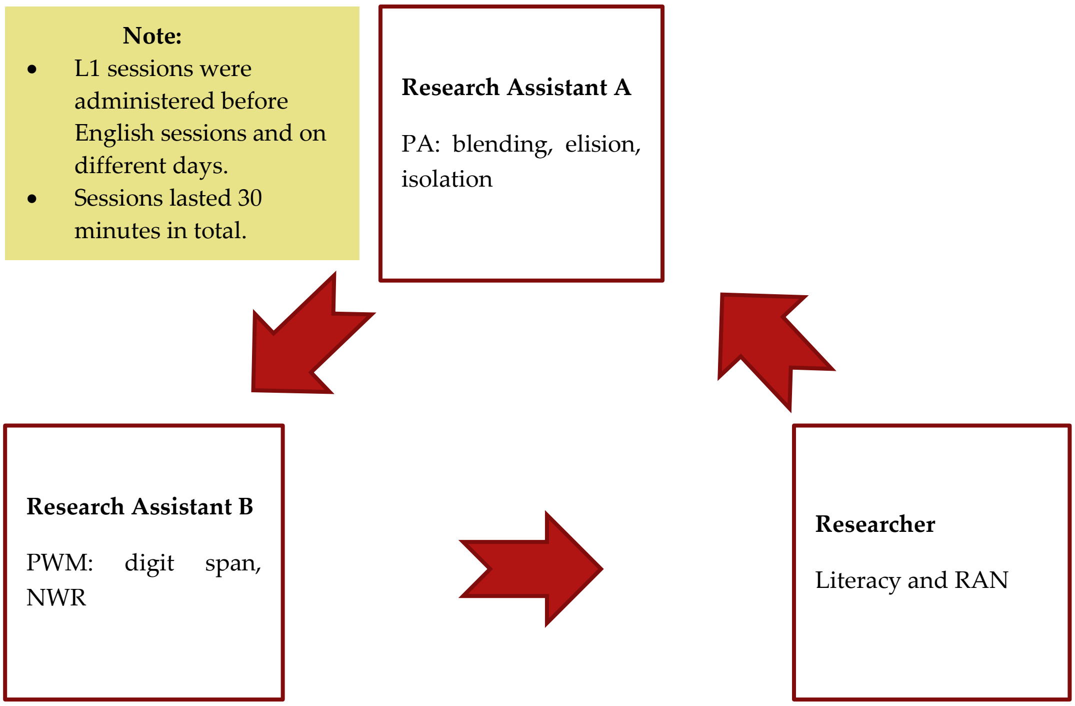

Figure 3-3. Schematic diagram presenting the order of task administration for phonological processing and literacy tasks

Within a session, the assessments were administered in a fixed order (PA to PWM to literacy) (*Figure* 3-3) to reduce negative transfer of task effects. For example, in the pilot study, it was clear that participants who moved from the NWR and digit span task to the PA task were more likely to repeat the stimuli as they had done in the previous tasks than attempt to complete the PA task. This is because the phonological memory tasks require repetition. Thus, in the main study, the participants moved from the PA tasks to the PWM tasks. Tasks were administered by the same person at each time point to ensure rater consistency. The PA and PWM tasks were also audio recorded so that I could determine inter-rater reliability.

A test session booklet was created for each participant which included their demographic details, which classroom they were from, as well as the instruction and scoring for each task. Participants carried this booklet to each team member. The team member used the booklet to record the date, scores, and any other notes. Participants received a small sticker after each language session as a token of thanks.

The quality of the collected data was ensured through training the research assistants, daily observation of assessments and reflection, daily checking of score sheets, and weekly review of the audio recordings (for the phonological processing tasks). Firstly, the research assistants were provided training on how to administer the assessments. I conducted the training and provided demonstrations and feedback. Second, when at the schools, I would listen to and/or observe the research assistants administering the tasks and provide feedback on how to administer the tasks correctly. The research assistants and I also reflected at the end of each day about what went well or badly, and how to overcome challenges. Everyone had an opportunity to ask questions of clarification to make sure they felt comfortable and confident assessing the learners. This ensured that everyone was aware of exactly how they should be performing. Third, I checked the score sheets each day to make sure that there were no missing responses and that the scores were legible. There were few non-responses, and the scores were legible. Finally, once a week, I listened to the audio recordings to check that the scoring was consistent. Feedback was provided to the research assistants when necessary and the recordings were used as examples for further training.

3.8.2 Data processing procedures

All scores were collected on paper score sheets, which I input into a comma separated file at the end of testing at each time point. Each participant was included in a row with a unique identifier used across waves, and the columns represented the variables, with a separate spreadsheet for each wave of data collection. All non-responses were marked as missing data. I took breaks often during data input to reduce errors from fatigue. Once the data was included in the .csv file I checked that there were no data input errors. I used R (The R Foundation for Statistical Computing, 2021) for data cleaning. I visualised the raw data using violin plots with jitter and ran descriptive statistics to calculate the number of missing data points per variable. This helped to identify where data had been shifted (resulting in higher-than-expected maximum scores for example) or missed (resulting in a missing value when there was actually a recorded score on paper). These unexpected data points were referenced to the paper score sheets and errors were corrected. There were few of these types of errors and any that arose were corrected before data analysis. The total scores for each variable were calculated. The data was processed into both wide and long forms for the data analysis, and the data from all three waves was merged for the longitudinal analysis.

3.8.3 Data analysis procedures

The data analysis for the main study was conducted in R version 4.1.2 (The R Foundation for Statistical Computing, 2021). The results of the cross-sectional data analysis are presented in chapter 4 (t1; end of grade 1) and chapter 5 (t2; start of grade 3). The data analysis for this cross-sectional data took place in four phases and is described in section 3.8.3.1. The results of the longitudinal analysis, and the cross-sectional analysis of end of grade 3 (t3) data, are presented in chapter 6. The analytic plan for the longitudinal data is presented in section 3.8.3.2

3.8.3.1 Cross-sectional analysis of data in grade 1 and grade 3

The cross-sectional analysis of t1 and t2 data was undertaken in four phases, including: descriptive statistics, correlation analysis, confirmatory factor analysis of the phonological processing constructs, and a path analysis. The cross-sectional analysis of t3 data was undertaken in two phases (descriptive statistics and correlation analysis). These phases are described below.

3.8.3.1.1 Phase 1: Descriptive statistics of observed variables

In the first phase of the analysis, I present an overview of the nature of the data through reporting the descriptive statistics (mean, median, minimum, maximum and proportion of scores that are zero scores) of the observed variables for each language group for each of the tasks. Descriptive statistics were calculated using the tidyverse set of tools (Wickham et al., 2019). I quantified the differences in means between the groups on observed variables using Cohen's *d* effect size (calculated using {effsize} (Torchiano, 2020), and its 95% confidence interval [26] to demonstrate uncertainty around the point estimate). Cohen's *d* is a standardized measure of mean differences (Wei et al., 2019), where the mean of the second group is subtracted from the mean of the first group; the resulting value is divided by the pooled standard deviation.

[26] The 95% CI would contain the population effect size in 95% of replications in the long run (Good, 2012).

Cohen's *d* is less affected by sample size and has a similar interpretation across studies (Larson-Hall & Plonsky, 2015; Plonsky & Oswald, 2014). I interpreted effect sizes that did not overlap with zero as being practically significant. For between-subjects comparisons (i.e. comparing the isiXhosa and isiZulu groups), I use Plonsky's and Oswald's (2014) suggested interpretations of effect sizes of between-subjects effects in second language research: .40 is small, .70 is medium, and 1.00 is large. For within-subjects comparisons (i.e. comparing the scores on different tasks for the same participants) I use their within-subjects suggestions for the interpretation of Cohen's d: .60 as small, 1.00 as medium and 1.40 as a large effect (Plonsky & Oswald, 2014). Although Plonsky and Oswald (2014) present these effect sizes for L2 research, I have used these same 'cut-off' values for the L1 comparisons. I also calculated the t-test statistic and its p value for the comparisons where the value of d did not overlap with zero. These p values were corrected for the false discovery rate due to multiple comparisons using the Benjamini and Hochberg (also known as FDR) correction method. This descriptive analysis acts as the first step at understanding whether the two language groups differ on any of the skills and also presents data which can be used in later meta-analyses by other researchers (Larson-Hall & Plonsky, 2015). I also include figures to visually demonstrate the distribution of data.

3.8.3.1.2 Phase 2: Correlation Analysis

In the second phase of the analysis, I determined the Pearson correlations among the observed variables. The correlation analysis allows me to comment on the inter-relationship between phonological processing skills per language group and the phonological processing and literacy skills per language group as well as the extent to which skills are interdependent cross-linguistically.

3.8.3.1.3 Phase 3: Confirmatory factor analysis of bilingual PA, RAN, and PWM

In the third phase, confirmatory factor analysis models were fit to the bilingual PA, RAN and PWM data, respectively, to determine whether the measures of each construct loaded onto a language general or language specific factor. This aspect of a construct is also referred to as its dimensionality. Dimensionality refers to how many latent variables a set of manifest variables represent (Furr, 2011). CFA confirms the common variance shared by the latent variable (i.e. the construct, e.g., PA) and its indicators (e.g., blending, elision and isolation) (Rhemtulla et al., 2020) and allows measurement error to be explicitly modelled. The use of latent variable analysis is justified in this instance because the scores on the indicators arise from participant ability on the latent factor. Specifically, this phase of the analysis determines to what extent each phonological processing construct is language general (loads on one factor) or language dependent in the L1 and English (loads on two factors). This third phase of the analysis allows me to address the inter-relationship among phonological processing skills. For the CFA, the RAN times were converted to items per second scores so that the tasks would have a positive correlation with PA and PWM.

I referred to the theory about bilingual phonological processing addressed in chapter 2 to specify competing statistical models of dimensionality. I specifically compared language general and language specific models of each construct, and for PWM and RAN, I also compared task general and task specific models. These models are addressed in more detail in the corresponding results sections. CFA models were fit using the MLR estimator (maximum likelihood estimation with robust Huber-White standard errors) because of non-normal and some missing data (where children were unable to pass the practice items, so the task was not administered). In R, the syntax, therefore, included *estimator = "MLR"* and *missing = "ML"*. The robust statistics are reported. For the PA models, the models were fit allowing the residuals of each method to correlate (e.g., the L1 blending and English blending tasks were allowed to correlate) as per Branum-Martin et al. (2015).

In order to determine whether a statistical model was supported, I referred to the scaled chi-square test which should not be significant. The null hypothesis is that the model is a good fit for the data (Netemeyer et al., 2003). I also referred to overall model fit (using robust statistics). According to Hu and Bentler (1999), model fit is adequate if CFI is greater than .95, RMSEA is less than .06 and SRMR is less than .08. Competing models were assessed using the chi-square difference test as well as the overall model fit statistics. As per Branum-Martin et al. (2015, p. 114) "[if] this chi-square test is above p = .05, the fit of the one-factor model is acceptable, compared to the two-factor model." That is, a significant result indicates that the two-factor model is preferable, and a non-significant result indicates that a one-factor model is preferable. Most importantly, I referred to theory to determine whether the best fitting statistical model was theoretically warranted.

The initial models were fit to the data for the whole group. After the configural model was established, the CFA model underwent measurement invariance testing using multigroup confirmatory factor analysis (MGCFA). Measurement invariance (also called measurement equivalence) testing determines whether a test measures the construct the same for different groups of test-takers, or in different contexts or at different points in time (Luong & Flake, 2022). In this case, I compared the isiXhosa and isiZulu groups at each timepoint using MGCFA. Measurement invariance is reached when it is demonstrated that group membership does not affect the relationship between the manifest variables (e.g., the elision, blending and isolation scores) and the latent variable (e.g., PA) (Wicherts & Dolan, 2010). This analysis allows me to address whether the relationships among the phonological processing skills are the same for the language groups. The research questions refer to differences between the isiXhosa and isiZulu groups but the scores on the latent variables can only be meaningfully compared if the constructs are measured similarly for each group.

There are four forms of increasingly stricter measurement invariance (Luong & Flake, 2022; Putnick & Bornstein, 2016). Researchers should start at the least strict form of measurement invariance testing, and progress to the next step if there is support for measurement invariance. Configural invariance, the least strict form of invariance, considers whether the model fits the data equally well for each group i.e., whether the latent variable factor structure is supported by data in each group. Metric (or weak) invariance considers whether the factor loadings are the same for each group i.e., whether the manifest variables measure the construct equally well for each group. Scalar (or strong) invariance considers whether the intercepts for each group are the same, i.e., it tests whether one group systematically performs more poorly than another group. Finally, strict invariance considers whether the item residuals are the same across groups. Strict invariance, in practice, is very difficult to achieve (Van De Schoot et al., 2015). Since strong/scalar invariance and not strict invariance is needed to compare latent means between groups on the latent variable, it is usually sufficient to demonstrate strong/scalar invariance, or partial strong invariance (when some intercepts are free to vary) (Putnick & Bornstein, 2016).

I fit increasingly stricter MGCFA models to the data comparing the isiXhosa and isiZulu groups. For the metric, and scalar models I fixed the loading of the anchor item to 1 and the factor means to 0 in both groups. I selected items I thought to be most invariant as the anchor item. After establishing that the configural model fit in both groups, I constrained the factor structure, then factor loadings, then item intercepts to be equal and compared each successive model to the previous one. At each step, overall model fit was decided based on the scaled chi-square and model fit statistics presented in the previous section. The nested models were compared using the chi-square difference test. A non-significant test indicates that the more constrained model adequately fits the data, and measurement invariance is supported (Luong & Flake, 2022). Secondly, the fit of the second model can be assessed by the difference in RMSEA and CFI between two nested models. In this study, I used overall adequate model fit, and a non-significant chi-square difference test as indicators of a better fitting more constrained model. Where these considerations did not all agree, I used overall model fit of the nested model and then the non-significant chi-square difference test to determine whether the more constrained model was better. If the nested model fit well and the chi-square difference test was not significant, then metric invariance was accepted.

If the model results in poorer fit, then metric invariance should be rejected. If measurement invariance was rejected, I attempted to determine partial measurement invariance. If measurement invariance was rejected at the configural invariance step, I used the *lavInspect* function in {lavaan} to identify which variables were causing errors. Based on the results from lavInspect() I edited the models to better represent the data. If the edited models would still not converge, I took this as evidence against the particular configural model and used only those models that did fit the grouped data adequately. If measurement invariance was rejected at the metric invariance step, I used modification indices from lavTestScore() to identify the loading(s) that should be freely estimated. I used a backwards procedure to free one loading with the largest value (which had to be theoretically motivated or based on my knowledge of the data collection context) and then fit the new model. If this new model was still not invariant, I repeated the process until the chi-square difference test with the configural model was not significant and the model had adequate fit. If measurement invariance was rejected at the scalar invariance step, I used modification indices from lavTestScore() to identify the intercept(s) that should be freely estimated. I used a backwards procedure to free one intercept with the largest value (which had to be theoretically motivated or based on my knowledge of the data collection context) and then fit the new model. If this new model was still not invariant, I repeated the process until the chi-square difference test with the (partial) metric model was not significant and the model had adequate fit. I did not determine strict invariance since this is often omitted in practice (Luong & Flake, 2022; Putnick & Bornstein, 2016). I determined whether the latent means were similar by constraining the means to equality. If this constraint led to worse model fit, this indicated that at least one mean was different at the latent level.

In summary, the CFA analysis indicates to what extent the tasks in each language are related to a language general or language specific construct. If the tasks are language general it suggests a high degree of transfer, or an underlying capability as suggested in the interdependence hypothesis and the central processing hypothesis. Measurement invariance testing indicates whether the tasks are equally good measures of the construct for both language groups. Measurement invariance testing also allowed me to determine whether the means of the constructs were the same for both language groups.

3.8.3.1.4 Phase 4: Path modelling predicting reading and spelling

Finally, in the fourth phase of the analysis, I used multigroup path analysis to determine the contribution of phonological processing skills in L1 and English to reading and writing in L1 and English. Two path models were fit: one predicting reading and one predicting spelling. Letter sound recognition fluency was included as a mediator in both models because of its role as a foundational literacy skill that is dependent on phonological processing skills. First, the multiple indicators were reduced to principal components for each construct and these values used in the analysis. The model was fit simultaneously to each group. Equality constraints were included to determine whether the regressions were equal in each language group. Modification indices were used to identify which constraints should be relaxed if adding constraints lead to worse model fit. Indirect effects and total effects of the predictors on the outcomes were calculated. This analysis is used to address what the relationships are between the phonological processing skills and literacy and whether they are the same for each language group as well as to demonstrate whether there is evidence of language transfer.

3.8.3.2 Longitudinal analysis of data from grade 1 to grade 3

The longitudinal analysis included establishing the developmental trajectories of the phonological processing and literacy skills (section 3.8.3.2.1) and examining the longitudinal relations among skills (section 3.8.3.2.2).

3.8.3.2.1 Developmental trajectories

The developmental trajectories were examined using multilevel models (also called linear mixed effects models). The models were fit using lmer in {lmerTest} (Kuznetsova et al., 2017) using restricted maximum likelihood estimation and the Kenward-Roger correction (McNeish, 2017). Fixed effects were included for timepoint, language group and the interaction by timepoint and language group. Timepoint was treated as continuous by centring at the first assessment point (zero), and the number of terms that passed as reflected for t2 (6 terms) and t3 (8 terms). Language was treatment coded such that isiXhosa was 1 and isiZulu was 0. Random effects included a varying intercept by subject. The model took the form in equation 1 and was fit to each assessed variable.

(1) *variable* ~ 1 + time + language + time*language + (1 | id)

Using this equation, the coefficient of time represents the average increase in the score per term starting from term 2 of grade 1. If this coefficient is significant, it indicates that there was growth in the skill on average from t1 to the last time point (t2 for phonological processing skills, t3 for reading skills). The coefficient of language represents the extent to which the isiXhosa group's intercept differs from that of the isiZulu group (which is the reference group). Should this term be significant, it indicates that the groups had different scores at the start of the study. The time by language interaction indicates to what extent the slope of the isiXhosa group differs from the isiZulu group. Should this term be significant, it indicates that the developmental trajectory for the groups differed.

Raw scores for the variables were used, except for RAN naming time which was transformed to an items per second score to improve the distribution of model residuals. The transformed RAN scores were also multiplied by -1 to preserve the interpretation that smaller numbers are better as when viewing the figures. The intra-class correlation (ICC) was reported as a measure of effect size. The ICC is the proportion of variance of the outcome variable that is explained by the cluster variable (in this case, the individual participants) (Lorah, 2018).

3.8.3.2.2 Longitudinal relations

Multigroup path models were used to determine the longitudinal relations between t1 phonological processing and t1 vocabulary and t2 and t3 reading fluency and spelling, and between t2 phonological processing and t3 reading fluency, reading comprehension and spelling. Path models were chosen for this analysis as they allow the estimation of multiple outcome variables, and because equality constraints can be included to determine whether the relations are the same in each language group. Thus, the path models were first fit to each group allowing all regressions to vary. Then the regressions, and covariances between the outcomes were constrained to determine to what extent the predictors of later literacy were of similar strength in each group.

3.9 PILOT STUDY

3.9.1 Introduction

A pilot study was conducted at the start of the study in the first and second terms of 2019 to determine whether some of the L1 tasks were reliable and of a suitable level for use with grade 1 participants. The pilot study was also used to finalise the order of administration of tasks, and to fine tune the training of the research assistants.

3.9.2 Participants

40 randomly selected children participated in the pilot study. Half were from School Z1, and half were from School X1. Half the participants in each school were girls. The participants had an average age of 6.6 years (SD = .4) at time of testing.

3.9.3 Instruments

Only some of the instruments used in the study were piloted, as explained in section 3.7. The instruments that were piloted in isiXhosa and isiZulu included: the translated and adapted PPVT-IV Form A (vocabulary); elision, blending and isolation tasks (PA); digit span and NWR tasks (PWM); and rapid naming of objects, colours, letters, and digits tasks (RAN).

3.9.3.1 Pilot L1 vocabulary instrument: Form A of PPVT-IV

The translation and adaptation of Form A of the PPVT-IV (Dunn & Dunn, 2007) was addressed in section 3.7.3.2. In summary, the first 9 sets (108 items) of Form A were translated into isiXhosa and isiZulu and changes were made to some items to ensure that they were contextually appropriate and similar in both languages. The test was first piloted with the isiZulu group. Thereafter, two more sets were translated, adapted, and piloted in the isiXhosa group (132 items). In the pilot study, participants were presented all the items (i.e., there was no discontinuation rule).

3.9.3.2 Pilot L1 phonological awareness tasks

The rationale for the development of the isiXhosa and isiZulu PA tasks and examples of the tasks were addressed in section 3.7.2.1.2. The pilot tasks differed from the final tasks in that there were two forms (Version A and Version B) for blending, elision, and isolation. Two forms were created so that more items could be piloted, and only the best performing items selected for the final tasks.

The pilot version of the blending task contained 10 syllable blending items and 12 phoneme blending items for a total of 32 items in each version of the task. The items ranged from one syllable (i.e., two phonemes) to four syllables (i.e., 8 phonemes) in length. 12 items were verbs, and the remainder were nouns. 9 of the items were in the top 1500 most frequent words for both languages, and the rest of the items were in the top 1501 – 5000 category or did not have a frequency level specified. The blending items were said by the research assistant and not recorded. The syllable blending part of the task included one item simulating word blending (e.g., *i-phepha-*ndaba ~ NC-paper-news), 3 x 2 syllable words, 3 x 3 syllable words, and 3 x 4 syllable words. The phoneme blending part of the task included 2 x 1 syllable words, 5 x 2 syllable words (ranging from 3-4 phonemes), 3 x 3 syllable words (ranging from 5-6 phonemes) and 2 x 4 syllable words (i.e., 8 phonemes). The task increased in difficulty from the easiest items (what word does *i-phepha-ndaba* make?) to the most difficult (what word does *b-a-l-u-l-e-k-a* make?). In some cases, Versions A and B differed minimally from each other (e.g., Version A: *i-nja*; Version B: *i-ndlu*) and in some cases the words were very different from each other (e.g., Version A: *nya-ma-la-la*; Version B: *se-be-nzi-sa*).

The pilot version of the elision task contained 10 syllable elision items and 11 phoneme elision items for a total of 21 items in each version of the test. 10 items were two syllables long and 11 items were three syllables long. 13 items were verbs and 8 were nouns. 9 of the items were in the top 1500 most frequent words for both languages, and the rest of the items were in the top 1501 – 5000 category or did not have a frequency level specified. The syllable elision part of the task included one item requiring elision of the first syllable of a bisyllabic word, one item requiring elision of the second syllable of a bisyllabic word, 2 items requiring deletion of the first syllable of a three-syllable word, 3 items requiring elision of the second syllable of a three-syllable word, and 3 items requiring elision of the last syllable of a three-syllable word. For the phoneme elision part of the task, 9 items required deletion of the first phoneme (2 of these were vowel first phonemes). Additionally, in Version A, one item required deletion of a phoneme in a cluster, and one item required deletion of a phoneme in coda position (*izim*[27] without *m*), and in Version B, two items required deletion of a consonant in a cluster. The initial consonants differed in their manner of articulation, including stops, fricatives, nasals, and clicks. The task increased in difficulty. The two syllable words were presented before the three syllable words in the syllable elision sub-task, but the order was mixed in terms of whether the first, second or third syllable had to be deleted. The phoneme elision sub-task also increased in difficulty with the deletion of initial vowels first, followed by initial singleton consonants followed by deletion of consonants in a cluster.

The pilot test had 11 phoneme isolation items (5 nouns, 6 verbs). The items ranged from 1 syllable to 3 syllables in length. The 2 x 1 syllable items required isolation of the first phoneme. 2 x 2 syllable VCV words required isolation of the middle consonant, and 1 x 2 syllable VCV words required isolation of the final vowel. The four and five phoneme words required isolation of the second (2 items), third (2 items) and fourth (2 items) phonemes. 5 of the items were in the top 1500 most frequent words for both languages, and the rest of the items were in the top 1501 – 5000 categories. The one syllable items were presented first. Thereafter, the items were mixed in terms of their difficulty.

The first four items in each task were used as examples and corrective feedback was provided to participants. Participants were presented with all the items in each task (i.e., there was no discontinuation rule). Half the participants in each language group completed Version A and half the participants completed Version B.

3.9.3.3 Pilot L1 PWM tasks

The rationale for the development of the isiXhosa and isiZulu digit span and NWR tasks and examples of the tasks were addressed in section 3.7.2.2. All items were administered in the pilot versions of the tasks, i.e., there was no discontinuation rule.

3.9.3.4 Pilot L1 RAN tasks

Rapid naming of objects, colours, letters, and digits was piloted. The rapid letter and object naming tasks in L1 were addressed in section 3.7.2.3.2. The rapid colour and digit naming tasks used in the pilot are described below.

[27] Noun - giant

Participants were required to name six colours (green, red, orange, black, brown, and yellow) and six digits (1, 2, 3, 4, 5 and 6) presented on a 9 by 4 chart in semi-random order as fast as they could. The English rapid colour naming chart from the CTOPP-2 was adapted to better suit the languages because isiXhosa and isiZulu use the same root word for *blue* and *green* which is modified to indicate which colour is referred to. The chart from the CTOPP-2 was then changed so that *blue* was replaced by *green*, and *green* was replaced by *orange*. The words for the colours in L1 are included in *Table 3-15*. The English rapid digit naming chart was also changed to ensure similarity between isiXhosa and isiZulu. As mentioned for the digit span task in section 3.7.2.2.2, isiXhosa and isiZulu digit names have similar syllable lengths only for digits one to six. The chart from the CTOPP was therefore changed so that *seven* was replaced by *six*, and *eight* was replaced by *one*, so that the task included digits 1 to 6.

Table 3-15. Colour names in isiXhosa and isiZulu

English	isiXhosa	isiZulu
green	luhlaza	luhlaza
red	bomvu	bomvu
orange	i-orenji	orenji
black	mnyama	mnyama
brown	ntsundu	nsundu
yellow	mthubi / lubhelu	liphuzi

For all four pilot rapid naming tasks, participants first completed a practice trial where their knowledge of the colours, objects, letters and digits in isiXhosa or isiZulu was checked. For the digits task, participants were first asked to count to six in their L1, to determine if they knew digit names in L1. Participants who made errors completing the practice items received corrective feedback. If more than one item was consistently still named incorrectly after receiving corrective feedback, or if the Home Language digit names were not known, the task was not administered. The timer was started when the participant named the first item, and the timer was stopped when they completed naming the last item. The total time taken to name all items was recorded. Any errors made were indicated on the score sheet.

3.9.4 Procedures

Data collection took place in the school staff rooms in the second term (isiZulu and isiXhosa) and the start of the third term (isiXhosa) of grade 1. The vocabulary pilot test was administered in one session, and the phonological processing pilot tests were administered in a second session. The piloted phonological processing tasks were administered by two research assistants; one assistant administered the PA tasks, and one assistant administered the PWM and RAN tasks. Two participants were tested in the same session and moved between the two testers to complete all tasks in the session. Initially, the task order between testers was counter-balanced so that the first pair of participants moved from PA to PWM and RAN, and the second pair of participants moved from phonological memory and RAN to PA. However, a task order effect was present. Participants who completed the PWM and RAN tasks first and then moved to the blending task were more likely to repeat the tester rather than blend the sounds into a word. To minimise confusion for the participants, the test order was fixed so that the PA tasks were completed before the PWM tasks.

Scores were recorded on paper and later typed into an excel spreadsheet. IBM SPSS Statistics for Windows version 26 (IBM Corp, 2019) was used to analyse the data from the pilot study. Descriptive statistics were calculated to determine the distribution of scores. Cronbach's alpha was used to estimate the internal consistency of the tasks. If the scale was not sufficiently reliable, Cronbach's alpha after deleting each item from the scale was also calculated to identify items which reduced the internal consistency of each scale. The language groups were also compared to ensure that items functioned similarly in both languages.

3.9.5 Results and discussion

The results of each task are presented and then discussed in the same section for ease of reading. The tasks measuring the same construct are addressed in the same section.

3.9.5.1 Vocabulary

The results of the pilot vocabulary test are presented in *Table 3-16*. The isiZulu pilot test had a maximum of 108 items so the data for isiXhosa for these same 108 items is provided, as well as for the total 132 items piloted in isiXhosa. The data show that the pilot test results are normally distributed for each language. An independent samples t-test indicated that the isiXhosa group had a larger vocabulary than the isiZulu group on the 108-item pilot test, $t(38) = 4.45$, $p < .001$, $d = 1.41$. The mean difference of 11 items represented a large effect size. Both language versions of the test had acceptable reliability ($\alpha = .73$). The pilot test was retained for the final study because it was sufficiently reliable and elicited a normal distribution of scores in both languages.

Table 3-16. Distribution, reliability, and normality of the raw scores of the piloted vocabulary test in isiXhosa and isiZulu

	isiXhosa		isiZulu
	Vocabulary (108 items)	**Vocabulary (132 items)**	**Vocabulary (108 items)**
N	20	20	20
Cronbach's alpha	.73	.74	.73
Mean	74.1	84.6	63.0
Standard Deviation	7.6	8.9	8.2
Minimum	59.0	67.0	48.0
Maximum	94.0	108.0	75.0

3.9.5.2 Phonological awareness

Two isiXhosa participants who participated in the pilot vocabulary task were not available for testing during the phonological processing pilot. Additionally, the tasks of two isiZulu participants were discontinued because they were unable to complete the tasks and were visibly upset at not being able to do so. These two participants ended the tasks after syllable elision, were given positive feedback on the effort they had put in, given a sticker as a reward, and then dismissed back to class.

The results of the pilot PA tasks are presented in *Table 3-17*. Since the scores were very similar within each language for each version of the tasks, the participants were grouped together into isiXhosa and isiZulu groups. Independent samples t-tests were run to determine whether the means differed between the groups. The mean difference between the isiXhosa and isiZulu groups was statistically significant only for phoneme isolation ($t(34) = -4.9$, $p < .001$) and not the other tasks: syllable blending: $t(36) = .1$, $p = .93$; phoneme blending: $t(36) = -1.8$, $p = .08$; syllable elision: $t(36) = -1.2$, $p = .23$; phoneme elision: $t(34) = -1.4$, $p = .18$. Given the small sample size it was not possible to determine whether the differences on phoneme isolation were due to language/sample differences or from the way the task was administered by different research assistants.

Table 3-17. Mean scores on the isiXhosa and isiZulu pilot PA tasks

	isiXhosa (N = 18)			isiZulu (N = 20^{+})		
	both	**A***	**B***	**both**	**A***	**B***
Syl. Blending (10)	9.7	9.4	9.9	9.7	9.5	9.9
Phon. Blending (10)	4.3	3.8	4.5	5.4	5.1	5.7
Syl. Elision (10)	3.2	2.8	3.5	3.9	4.1	3.7
Phon. Elision (11)	2.7	3.1	2.5	3.4	3.8	2.9
Phon. Isolation (11)	4.7	5.1	4.1	7.2	6.9	7.5

Notes: * test version; $^{+}$ N = 18 for phoneme elision and isolation tasks.

The results from the whole pilot sample, as well as each language group were analysed to determine whether the tasks worked well in both languages, as well as overall. When looking at the entire group (N = 36), the test had a good distribution of scores with a mean of 27.5 (SD = 5). Cronbach's alpha was used to determine the reliability of the PA scale. Overall, when all participants were considered together, the test had acceptable reliability (α = .71). However, when looking at task performance for each language group, the isiZulu group had more participants who scored high, and the isiXhosa group had more participants who scored lower. The reliability of the PA task was acceptable for isiXhosa (α = .70), but less than acceptable for isiZulu (α = .44), which was quite unexpected since the items in both languages were almost identical. Cronbach's alpha of the item when deleted was calculated for each language to identify less reliable items. Items which reduced the reliability of the total scale were similar for both groups. Item level scores were also compared between languages to identify which items to leave in for the final test. It was important that the same items were used in both languages to reduce other variables influencing the scores. Items which reduced reliability of the overall scale and had very different scores for each language group were omitted until the overall scale was a feasible length. Some easier items (e.g., syllable blending) were kept in the test, even though they reduced reliability slightly, to ensure that there would not be floor effects. While the isiXhosa pilot version was acceptably reliable, it was not possible to shorten that test and use the same items in isiZulu because many of the items had very different scores in each language.

The resulting PA task had the same reliability in each language (α = .58) which was less than acceptable, but when the result of all participants was considered, the final test had acceptable reliability (α = .70). It was more important for the tasks to be as similar as possible, with the expectation that the reliability would improve in the main study when using a larger sample to calculate the statistic.

3.9.5.3 Digit span task

The language groups performed similarly on the digit span task with means of 6.2 (SD = 2) and 6.1 (SD = 2.1) for isiXhosa and isiZulu respectively, t (35) = .17, p = .863. The reliability of the test was slightly less than acceptable (α = .66) but this is possibly due to items with no variance (all correct and all incorrect) being excluded from the calculation resulting in a reduced number of items being included. The task was left as is for the final study since it was modelled very closely on the CTOPP-2 which is reliable. The only change was made to the recordings where the 1.25 second gap between digit segments was shortened to .25 seconds.

3.9.5.4 NWR task

The isiXhosa (M = 15.8, SD = 2.8) outperformed the isiZulu (M = 10.3, SD = 3.3) group on the piloted NWR task. The mean difference of 5.5 items reached significance, t (35) = 5.4, $p < .001$. The Cronbach's alpha estimate of internal consistency was .61 for the isiXhosa group, and .74 for the isiZulu group. The reduced reliability in the isiXhosa group is probably due to the reduced number of items included in the analysis because some items were all correct. All of the isiXhosa pilot participants correctly repeated the first six items of the pilot task, whereas there was more variability in the isiZulu group. Item scores in each language and Cronbach's alpha if item deleted was calculated and consulted to identify items that lead to differences in the groups and decreased the reliability of the scale. Again, it was important that the two language versions were similar, with the assumption that the reliability of the test would become higher with a larger sample from the main study. The Cronbach's alpha of the resulting version of the test was calculated, with low reliability per language version (isiXhosa: α = .53; isiZulu: α = 64) but acceptable for the pilot sample as a whole (α = .71). The training of the research assistants was also improved so that they listened carefully to each segment of the nonword so that points were awarded only to completely correct answers.

3.9.5.5 RAN tasks

The results of the RAN task are presented in *Table 3-18*. There were significant group differences between the language groups only for letter naming (t (14) = 2.7, p = .02), with the isiZulu group being slower than the isiXhosa group. The isiZulu group overall was less automatic in the recognition of letters, since the task was discontinued for 13 participants, and only completed by five participants. On the other hand, the letter naming task was only discontinued for seven of the isiXhosa participants. These differences may be due to differences in school instruction. The letter naming task was retained for the final study as letter naming is an important predictor of reading fluency. The object naming task worked well in both languages with participants making few errors. The task was retained for the final test. Colour and digit naming were not included in the final test because more than half the participants used English terms within the tasks, even after being corrected in the example trials. This finding is not unexpected since many people resort to using English colours and digits, through codeswitching/translanguaging in everyday interactions. I acknowledge the fluid nature of the languages of multilingual speakers, and the problems with language boundaries (Makalela, 2015). However, in the current study, it was important that the isiXhosa and isiZulu tasks were comparable. In terms of RAN, the timed nature of the tasks means that if some participants use a longer word for an item and some use the shorter word, the tasks will not be directly comparable. Thus, the piloted colour and digit naming tasks were not used in isiXhosa and isiZulu in the final study.

Table 3-18. Mean time and errors for the piloted RAN tasks in isiXhosa and isiZulu, including counts of participants who used English and for whom the task was discontinued

	All					isiXhosa					isiZulu				
RAN Task	**Disc.**	**Eng. Use**	**N att.**	**Mean Time**	**Mean Errors**	**Disc.**	**Eng. Use**	**N att.**	**Mean Time**	**Mean Errors**	**Disc.**	**Eng. Use**	**N att.**	**Mean Time**	**Mean Errors**
Object Naming	0	2	37	58.0	0.6	0	2	18	57.7	0.9	0	0	19	58.3	0.2
Colour Naming	3	22	34	70.1	3.8	0	17	18	69.3	4.3	3	15	16	71.0	3.2
Digit Naming	4	24	23	53.8	2.0	2	10	16	53.1	1.6	2	14	17	54.4	2.4
Letter Naming	20	-	16	68.0	3.6	7	-	11	54.9	2.4	13	-	5	96.8	6.2

Notes: Disc. – discontinued due to lack of automaticity during example; Eng. Use – used English consistently for one or more items, even when corrected; N att. = Number who attempted the task.

3.9.6 Summary of the pilot results

The vocabulary and phonological processing tasks were adapted from and modelled after English standardized tests, to ensure tests that measure the construct of interest in a language and context appropriate way. The assessments were piloted on 20 isiXhosa- and 20 isiZulu-speaking children in the same schools as the main study, and the results were used to determine the internal reliability of the tasks. The small sample size of the pilot resulted in possibly less than stable reliability estimates. Nevertheless, the results were used to ensure that items functioned similarly for the isiXhosa and isiZulu groups, with the assumption that the internal consistency of the tasks would improve with larger sample sizes in the main study. The piloting process was used to determine the order that tasks were administered in to avoid task order effects. Thus, in the final study, the PA tasks were administered before the PWM tasks to reduce confusion in the tasks. Finally, the pilot was also used to identify where the training of research assistants required revision. More training was deemed necessary for the NWR task to ensure consistency across language groups. The piloting processes ensured that the instruments were comparable between languages groups, were consistent, and that raters were consistent in their scoring. These processes contributed to the trustworthiness of the final research instruments used in the main study.

3.10 CONCLUSION

In this chapter I presented the research design for the study and justified why the research design and data collection instruments would enable the collection and analysis of relevant data to answer the research questions. The ethical implications of the research were carefully considered to ensure respect for persons, beneficence, and justice. Open-science principles, such as making the research instruments open-access, contributed to greater transparency.

The descriptive longitudinal design allows me to determine how the cognitive-linguistic and literacy skills have developed over time. The inclusion of two groups of participants that differ by first language enable me to determine whether these developmental trends are similar for children using closely related languages. The research instruments were carefully considered for how they measure each construct in each language. Except for some of the literacy sub-skills, all sub-skills were measured with more than one task which ensured a more comprehensive measurement of the construct. The use of standardized English tests, and isiXhosa and isiZulu literacy tests already used with samples in South Africa ensured that raw scores can be compared to other similar samples. I developed phonological processing measures based on the CTOPP 2 with consideration of word frequency, and word structure in isiXhosa and isiZulu. The developed tests were also piloted to ensure they were suitable for the research context. These design choices mean that the tasks are parallel in design and at item level, reducing the variation in scores which may be due to the test itself. I also specified the data analysis procedures that will be used to answer the research questions

I also provided contextualised information about the research sites and participants, and the possible influence of the COVID-19 pandemic on academic outcomes. The descriptions of the national, provincial, and school contexts, and the participants' home backgrounds were provided so that the quantitative findings can be interpreted considering the protective and risk factors in participants' contexts. It is likely that contextual factors play a large role in the developmental trajectories of cognitive-linguistic and literacy skills, so this study sheds light on the developmental trajectory in this specific context.

In the following chapters I present the cross-sectional results of the study for grade 1 (chapter 4) and the start of grade 3 (chapter 5), and I present the longitudinal results which identify the longitudinal predictors of literacy skills from grade 1 to grade 3 (chapter 6). I discuss these results and how they answer the research questions in the final chapter (chapter 7).

4 Chapter 4. The relationship between cognitive-linguistic skills and literacy skills in grade 1

4.1 INTRODUCTION

In this chapter, I address the concurrent (cross-sectional) within- and between-language relationships between cognitive-linguistic skills and literacy at the grade 1 timepoint (t1). This chapter begins with a summary of the method followed at t1. The results are then presented beginning with the descriptive statistics, correlations, confirmatory factor analyses of bilingual dimensionality, and ending with a presentation of the path analyses.

4.2 METHOD

For ease of reference, this section briefly summarises information about the participants, research instruments and procedures which were used at the grade 1 timepoint, as presented in chapter 3.

4.2.1 Participants

The grade 1 sample included 143 participants. Four of these participants (all from the isiZulu MOI schools) were excluded from the present analyses as they completed only the vocabulary test (i.e., they did not complete phonological processing and literacy tests). The sample used in this chapter, thus, included 139 participants. Sixty-nine participants attended isiXhosa MOI schools (in a more homogenous rural community) and 70 attended isiZulu MOI schools (in a more heterogenous urban community). The isiZulu group consisted of participants from two schools. Twenty-six participants were in Zulu school 1, and 44 participants were in Zulu school 2. The participants in each isiZulu school were grouped together for further analysis. Girls accounted for slightly more than half of the sample (58%), and this proportion is similar in each language group. The mean age of participants at the time of literacy testing in the sample was 6.9 years (SD = 0.4 years). The difference in age between the isiXhosa group (M = 6.9, SD = 0.5), and the isiZulu group (M = 6.8, SD = 0.4) represented a small effect size, but was not significant according to a Welch's independent samples t-test (t = 1.91, p = .06, d = 0.3, 95% CI [0.0, 0.7]).

4.2.2 Instruments

Participants completed a battery of cognitive-linguistic and literacy tests. These tests and which constructs they measure are presented in summary form in *Table 4-1*. Chapter 3 addressed the instruments used at t1 in more detail, including their inter-rater reliability and internal consistency estimates for the current sample. The t1 test is included in appendix A3.1 in section 9.3.1.

Table 4-1. The isiXhosa, isiZulu and English tests used to measure each construct in grade 1

Construct	isiXhosa/isiZulu Test	English Test
Vocabulary	Adaptation of PPVT IV Form A (Dunn & Dunn, 2007).	PPVT IV Form B (Dunn & Dunn, 2007).
PA	Constructed tests based on CTOPP (Wagner et al., 2013a): • Syllable and phoneme blending • Syllable and phoneme elision • Phoneme isolation	CTOPP (Wagner et al., 2013a): • Blending • Elision • Isolation
PWM	Constructed tests based on CTOPP (Wagner et al., 2013a): • Forward digit span • NWR	CTOPP (Wagner et al., 2013a): • Forward digit span • NWR
RAN*	Constructed tests based on CTOPP (Wagner et al., 2013a) and used in EGRS 2 (Department of Basic Education & University of the Witwatersrand, 2020): • Object naming • Letter naming	CTOPP (Wagner et al., 2013a): • Object naming • Colour naming • Digit naming
LRF	LRF task from the EGRA (Department of Basic Education & University of the Witwatersrand, 2020).	Not assessed in English.
Word Reading	Constructed tests based on DTWRP (Forum for Research in Literacy and Language Institute of Education, 2012) • Regular word reading	DTWRP (Forum for Research in Literacy and Language Institute of Education, 2012) • Nonword reading • Regular word reading • Irregular word reading
Text Reading	Oral reading fluency task used in EGRA (ERA, 2016c, 2016b).	Oral reading fluency task used in EGRA (ERA, 2016a).

Notes: * RAN tasks are not parallel in L1 and English as piloting showed that colours and digits were known predominantly in English. EGRA – Early Grade Reading Assessment; PPVT – Peabody Picture Vocabulary Test; CTOPP – Comprehensive Test of Phonological Processes; DTWRP – Diagnostic Test of Word Reading Processes.

4.2.3 Data collection procedure

In grade 1, participants completed the vocabulary tests in one session in the second academic term of 2019. They completed the battery of phonological processing and literacy tests over two sessions in the third academic term. One session was dedicated to each language with the L1 tests presented first. The scores were recorded on paper. After each data collection timepoint, I recorded the data in a comma delimited file and then loaded the data into R for data checking and analysis. I checked for unexpected missing data using {visdat} (Tierney, 2017), and, in addition, I checked for data input errors by examining the minimum and maximum scores for the variables. Very few data input errors were detected (e.g., one value was out of plausible range because of skipping a column during data entry). Such errors were corrected in the raw data file after checking the hard copy score sheet. Where data was missing (e.g., because the child was absent, or because the score was not recorded on paper and not retrievable from the recordings) it was coded with NA (the default indicator of missing data in R).

4.2.4 Data analysis procedure

Data analysis was undertaken in four phases which included descriptive statistics to understand the spread of the data, correlation analysis to determine the bivariate associations between variables, confirmatory factor analysis and measurement invariance testing of bilingual phonological processing to determine how the tasks load on the theorised constructs, and path analysis to determine the relations between phonological processing and literacy variables. These phases are described in more detail in section 3.8.3.1 of chapter 3. The results are presented in these four phases.

4.3 RESULTS

4.3.1 Descriptive statistics

Table 4-2 includes the sample size, median, mean, standard deviation, minimum and maximum scores and the proportion of participants scoring. These statistics are presented per task and per language group. The median and proportion of children scoring zero are included since at this stage of schooling the data was not normally distributed for most tasks. Effect sizes and their confidence intervals are presented in the table, rather than p values as suggested by Larson-Hall and Plonsky (2015). I interpreted the effect sizes using the guidelines of Plonsky and Oswald (2014) who suggested revised benchmarks of $d = .40$ (small), $d = .70$ (medium), and $d = 1.0$ (large) based on observed effect sizes in Applied Linguistics research. The confidence intervals of the effect sizes which do not overlap with zero are indicated in bold in *Table 4-2*.

Table 4-2 shows that for almost all the between-groups comparisons, the isiXhosa and isiZulu groups did not differ in the mean scores, since the effect sizes overlapped with zero. The groups differed on L1 and English vocabulary, L1 and English NWR, English RAN Objects and English RAN Colours. I provide a discussion of these results in the sections which follow, where these between group comparisons are addressed in more detail. For these tasks which had effect size confidence intervals which did not overlap with zero, I ran t-tests using the Benjamini and Hochberg (also known as FDR) correction method to control for Type 1 errors. These results are presented in the text. I also report the within-subjects' effects for tasks which had a similar metric for the L1 and English versions. For example, the vocabulary scores were measured in the same way (total raw score), RAN was measured in number of seconds, and word reading was measured in number of words read correctly. In terms of within group effects, I also used the suggested revised benchmarks of Plonsky and Oswald (2014) of d = .60 (small), d = 1.0 (medium), and d = 1.4 (large) for within-subject effects in Applied Linguistics research.

Table 4-3 presents the descriptive statistics for the combined sample. This table is included only to provide access to the combined sample, for future researchers who might want to conduct a meta-analysis (e.g., if their interest is solely on English L2) (Larson-Hall & Plonsky, 2015). The results in *Table 4-3* are, thus, not interpreted. In the following sub-sections I summarise the information of interest per task and include figures to visualise the data where appropriate.

Table 4-2. Distribution of scores by language in grade 1 including Cohen's d effect size

	isiXhosa							isiZulu							Effect Size	
Task (unit/ maximum)	**n**	**Md n**	**M**	**SD**	**Min**	**Max**	**% zero**	**n**	**Md n**	**M**	**SD**	**Min**	**Max**	**% zero**	**d**	**95% CI**
L1																
Name Writing	69	2.0	1.4	0.7	0	2	16	70	2.0	1.6	0.7	0	2	11	-0.3	[-0.7; 0.0]
Vocabulary (raw score)	69	74.0	73.3	16.4	25	99	0	70	59.0	58.8	16.8	29	91	0	**0.9**	**[0.5; 1.2]**
PA: Blending (/10)	69	3.0	3.6	2.1	0	10	6	70	3.0	3.2	1.9	0	9	1	0.2	[-0.1; 0.5]
PA: Elision (/10)	69	1.0	1.3	1.9	0	7	49	70	1.0	1.4	1.9	0	8	43	0.0	[-0.4; 0.3]
PA: Isolation (/5)	69	2.0	2.0	1.2	0	5	10	70	2.0	1.8	1.4	0	5	19	0.2	[-0.2; 0.5]
PWM: Digit Span (/15)	60	5.0	5.5	1.7	2	9	0	70	5.0	4.8	1.9	1	9	0	0.4	[0.0; 0.7]
PWM: Nonword Repetition (/18)	69	8.0	7.6	3.1	1	15	0	70	6.0	5.9	2.7	1	11	0	**0.6**	**[0.2; 0.9]**
RAN: Letters (seconds)	53	47.8	52.6	19.8	24	116	0	40	42.0	49.4	22.2	26	125	0	0.2	[-0.3; 0.6]
RAN: Objects (seconds)	68	52.8	56.1	13.2	32	98	0	70	55.3	54.6	11.7	34	101	0	0.1	[-0.2; 0.5]
Literacy: LRF (clpm)	68	14.0	15.5	13.1	0	61	6	70	12.0	13.2	11.8	0	50	10	0.2	[-0.2; 0.5]
Literacy: Regular Word Reading (cw)	69	0.0	3.9	6.5	0	20	52	70	0.0	4.0	6.8	0	20	63	0.0	[-0.3; 0.3]
Literacy: Text Reading (cwpm)	69	0.0	2.1	4.3	0	18	64	70	0.0	1.9	4.8	0	27	63	0.1	[-0.3; 0.4]
Literacy: Can spell 'imoto'	69	0.0	0.3	0.4	0	1	73	70	0.0	0.2	0.4	0	1	83	0.2	[-0.1; 0.6]
Literacy: Spelling (/6)	69	2.0	2.8	2.2	0	6	12	70	1.5	2.3	2.1	0	6	20	0.3	[-0.1; 0.6]
English																
Vocabulary (raw score)	69	26.0	24.9	12.1	3	64	0	70	29.0	31.6	14.0	10	72	0	**-0.5**	**[-0.9; -0.2]**
PA: Blending (/33)	69	4.0	4.9	4.3	0	17	17	70	3.0	3.4	3.7	0	16	26	0.4	[0.0; 0.7]
PA: Elision (/34)	69	1.0	3.5	4.4	0	22	35	70	1.0	2.8	3.5	0	15	30	0.2	[-0.1; 0.5]
PA: Isolation (/32)	68	7.5	7.5	5.7	0	25	10	70	6.0	6.3	5.6	0	25	10	0.2	[-0.1; 0.5]
PWM: Digit Span (/28)	69	13.0	13.3	2.5	8	20	0	70	13.0	13.1	2.5	8	21	0	0.1	[-0.3; 0.4]

Task (unit/ maximum)	isiXhosa n	isiXhosa Md n	isiXhosa M	isiXhosa SD	isiXhosa Min	isiXhosa Max	isiXhosa % zero	isiZulu n	isiZulu Md n	isiZulu M	isiZulu SD	isiZulu Min	isiZulu Max	isiZulu % zero	Effect Size d	Effect Size 95% CI
PWM: Nonword Repetition (/30)	68	15.0	15.3	3.1	7	22	0	68	12.0	12.4	2.8	7	17	0	**1.0**	**[0.6; 1.3]**
RAN: Colours (seconds)	51	71.0	71.4	22.8	30	132	0	65	54.0	57.4	18.4	33	122	0	**0.7**	**[0.3; 1.1]**
RAN: Digits (seconds)	67	42.5	47.1	16.4	22	93	0	67	43.1	46.9	17.6	22	98	0	0.0	[-0.3; 0.4]
RAN: Objects (seconds)	60	76.5	76.9	21.5	39	131	0	59	60.2	63.5	16.1	36	110	0	**0.7**	**[0.3; 1.1]**
Literacy: Nonword Reading (cw)	69	0.0	2.0	3.7	0	19	57	70	0.0	1.9	4.4	0	25	71	0.0	[-0.3; 0.4]
Literacy: Regular Word Reading(cw)	69	0.0	1.0	3.0	0	22	74	70	0.0	1.3	3.3	0	17	71	-0.1	[-0.5; 0.2]
Literacy: Sight Word Reading (cw)	69	0.0	0.9	2.3	0	15	73	70	0.0	0.7	1.6	0	7	73	0.1	[-0.3; 0.4]
Literacy: Text Reading (cwpm)	69	0.0	3.2	7.1	0	45	65	70	0.0	3.7	10.3	0	78	56	-0.1	[-0.4; 0.3]
Literacy: Can spell 'dog'	69	0.0	0.1	0.4	0	1	86	70	0.0	0.2	0.4	0	1	83	-0.1	[-0.4; 0.3]
Literacy: Spelling (/4)	69	0.0	1.0	1.5	0	4	62	70	0.0	1.2	2.3	0	4	71	0.1	[-0.3; 0.4]

Notes: Positive effect sizes indicate a higher mean for the isiXhosa group. Large values for RAN indicate slower naming. Effect sizes which do not overlap with 0 are indicated in bold. P values adjusted for multiple comparisons for these bolded comparisons are presented in the text. Clpm – correct letters per minute; cw – number of correct words; cwpm – correct words per minute.

Table 4-3. Distribution of scores in grade 1 for the entire sample

Task (unit/ maximum)	N	Median	Mean	SD	Min	Max	% zero
Home Language							
Name Writing	139	2.0	1.5	0.7	0.0	2.0	13.7
Vocabulary (raw score)	139	67.0	66.0	18.1	25.0	99.0	0.0
PA: Blending (/10)	139	3.0	3.4	2.0	0.0	10.0	3.6
PA: Elision (/10)	139	1.0	1.3	1.9	0.0	8.0	46.0
PA: Isolation (/5)	139	2.0	1.9	1.3	0.0	5.0	14.4
PWM: Digit Span (/15)	130	5.0	5.1	1.8	1.0	9.0	0.0
PWM: Nonword Repetition (/18)	139	7.0	6.7	3.0	1.0	15.0	0.0

Task (unit/ maximum)	N	Median	Mean	SD	Min	Max	% zero
RAN: Letters (seconds)	93	45.4	51.2	20.8	23.7	124.6	0.0
RAN: Objects (seconds)	138	53.9	55.3	12.4	31.7	101.3	0.0
Literacy: LRF (clpm)	139	13.0	14.3	12.4	0.0	61.0	7.9
Literacy: Regular Word Reading (cw)	139	0.0	4.0	6.6	0.0	20.0	57.6
Literacy: Text Reading (cwpm)	139	0.0	2.0	4.5	0.0	27.0	63.3
Literacy: Can spell 'imoto'	139	0.0	0.2	0.4	0.0	1.0	77.7
Literacy: Spelling (/6)	139	2.0	2.5	2.1	0.0	6.0	15.8
English							
Vocabulary (raw score)	139	27.0	28.3	13.5	3.0	72.0	0.0
PA: Blending (/33)	139	3.0	4.1	4.1	0.0	17.0	21.6
PA: Elision (/34)	139	1.0	3.2	4.0	0.0	22.0	32.4
PA: Isolation (/32)	138	6.5	6.9	5.6	0.0	25.0	10.1
PWM: Digit Span (/28)	139	13.0	13.2	2.5	8.0	21.0	0.0
PWM: Nonword Repetition (/30)	137	14.0	13.9	3.3	7.0	22.0	0.0
RAN: Colours (seconds)	116	57.9	63.6	21.5	29.5	131.6	0.0
RAN: Digits (seconds)	134	42.8	47.0	16.9	22.0	98.4	0.0
RAN: Objects (seconds)	119	66.8	70.2	20.1	35.7	130.9	0.0
Literacy: Word Reading - Nonwords (cw)	139	0.0	2.0	4.1	0.0	25.0	64.0
Literacy: Word Reading - Regular Words (cw)	139	0.0	1.2	3.2	0.0	22.0	72.7
Literacy: Word Reading - Sight Words (cw)	139	0.0	0.8	2.0	0.0	15.0	72.7
Literacy: Text Reading (cwpm)	139	0.0	3.5	8.9	0.0	77.5	60.4
Literacy: Can spell 'dog'	139	0.0	0.2	0.4	0.0	1.0	84.2
Literacy: Spelling (/4)	139	0.0	0.9	1.5	0.0	4.0	66.9

Notes: Clpm – correct letters per minute; cw – number of correct words; cwpm – correct words per minute

4.3.1.1 *Name writing*

Emergent literacy experience was measured by asking children to write their first and last names. *Table 4-2* shows that the mean score for the isiXhosa group was 1 (SD = 1) and for the isiZulu group was 2 (SD = 1) (*Table 4-2*). While most children were able to write both their first and last name, 16% of the isiXhosa group and 11% of the isiZulu group were unable to write either their first name or surname. Learning how to write one's name is part of handwriting in the grade 1 curriculum (Department of Basic Education, 2011a), although being able to "write" one's name is an aim mentioned in the pre-primary curriculum (Department of Basic Education, 2015).

4.3.1.2 *Vocabulary*

The vocabulary scores differed between the language groups (*Table* 4-2). There was a large effect size in favour of the isiXhosa group for L1 vocabulary: isiXhosa group M = 73 (SD = 16), isiZulu group M = 59, SD = 17), d = 0.9, 95%CI [0.5; 1.2], t(140.9) = 5.3, p < .001, q < .001. There was a medium effect size difference in favour of the isiZulu group for English vocabulary: isiXhosa group M = 25 (SD = 12), isiZulu group M = 32, SD = 14), d = -0.5, 95%CI [-0.9; -0.2], t(140.3) = -2.8, p = .006, q = .006 .

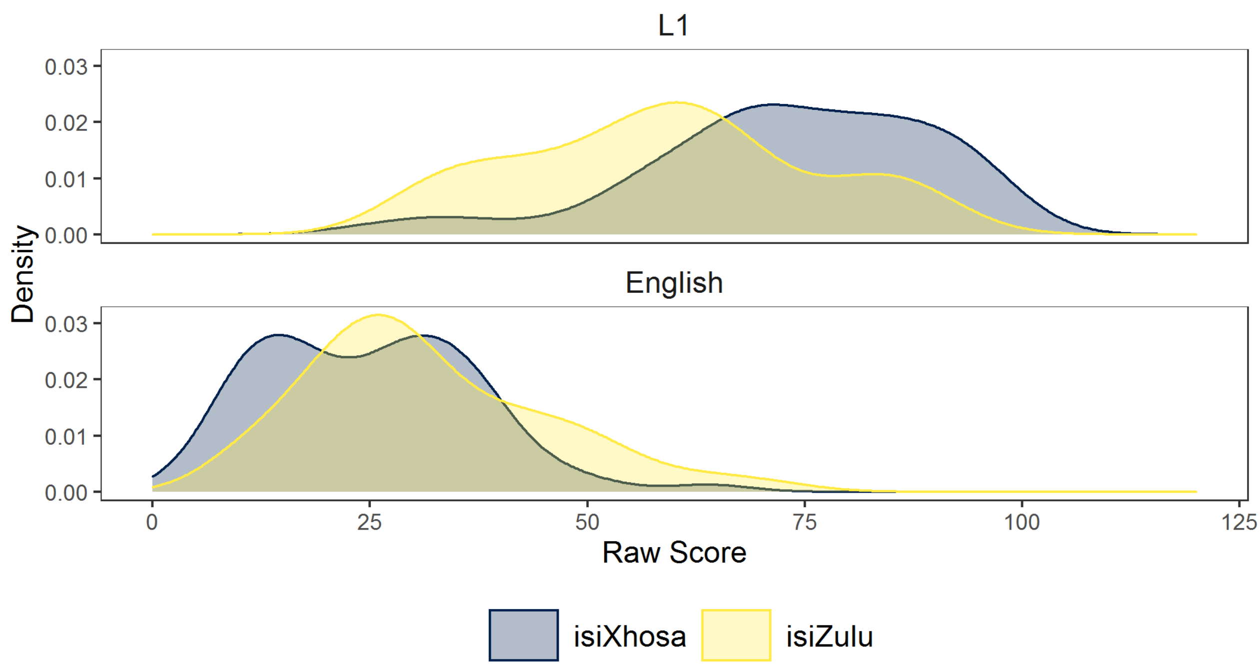

Figure 4-1. Density plots for vocabulary raw scores in L1 (top) and English (bottom) per language group in grade 1

These between group differences are visualised in *Figure* 4-1. With regard to within-subject effects, participants, on average, had larger vocabularies in their L1 than English: isiXhosa group, d = -3.3, 95%CI [-4.1; -2.6], isiZulu group, d = -1.8, 95%CI [-2.2; -1.3]. This large within-subjects effect size is most obvious in *Figure* 4-1 where there is less overlap in the distributions for the tasks administered in L1 and English. Although the confidence intervals for the effect sizes are also wide for the between-subjects comparison, the effect sizes remain large for both language groups.

4.3.1.3 Phonological awareness (PA)

The mean performance on the PA tasks did not differ between the language groups (*Table 4-2*). On average, for the tasks administered in L1, the isiXhosa group obtained mean raw scores of 4 (SD = 2), 1 (SD = 2) and 2 (SD = 1), and the isiZulu group scored 3 (SD = 2), 1 (SD = 2) and 2 (SD = 1), on the blending, elision, and isolation tasks respectively. On average, for the tasks administered in English, the isiXhosa group obtained mean raw scores of 5 (SD = 4), 4 (SD = 4) and 8 (SD = 6), and the isiZulu group scored 3 (SD = 4), 3 (SD = 4) and 6 (SD = 6), on the blending, elision, and isolation tasks respectively.

Figure 4-2 and *Figure 4-3* show the distribution of the scores in percentages. *Figure 4-2* shows the distribution of PA scores in percentages per task and test language. The same data split by language group is presented in *Figure 4-3*. Density plots show the proportion of data at each score and should be interpreted similarly to histograms. Although the L1 and English tasks had different maximum scores, the use of percentages enables the demonstration of a similar pattern in both languages of test administration: performance was lowest for elision, better for blending and best for isolation (*Figure 4-2*). Overall, the participants performed more poorly in the English tasks than the L1 tasks demonstrated by more clustering near zero for the English tasks (*Figure 4-2*). *Figure 4-3* shows that, generally, the groups overlap in their distribution of scores. However, for all tasks it appears that there are slightly more isiXhosa participants who have higher scores. Group differences will be further explored in the confirmatory factor analysis, which accounts for measurement error.

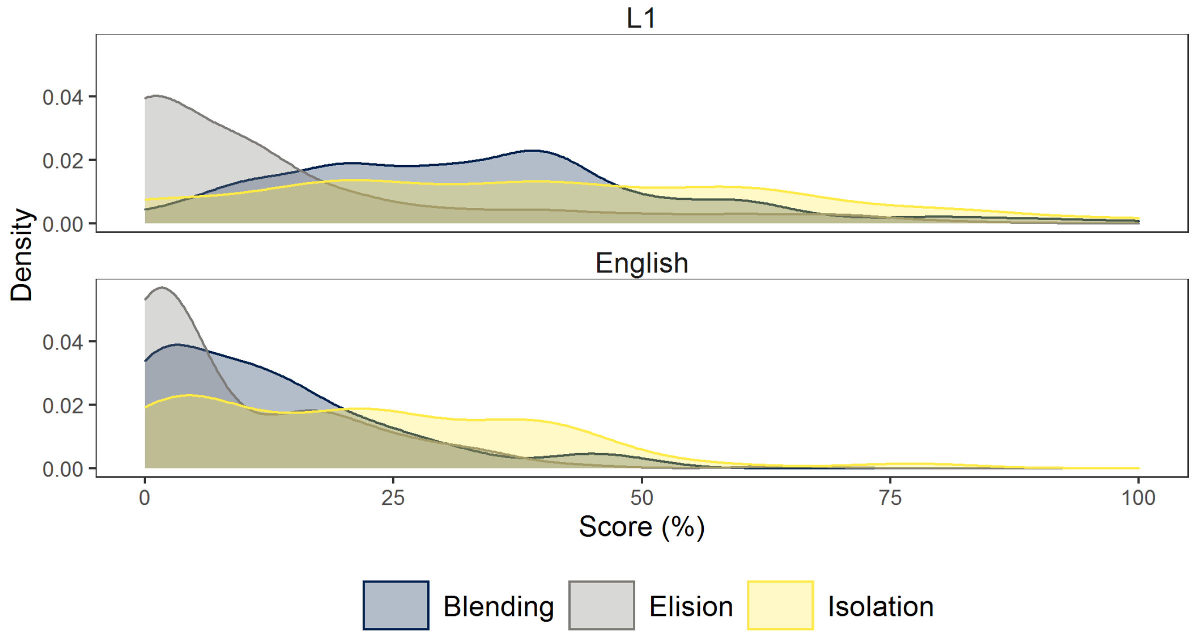

Figure 4-2. Density plots for PA tasks in L1 (top) and English (bottom) in grade 1

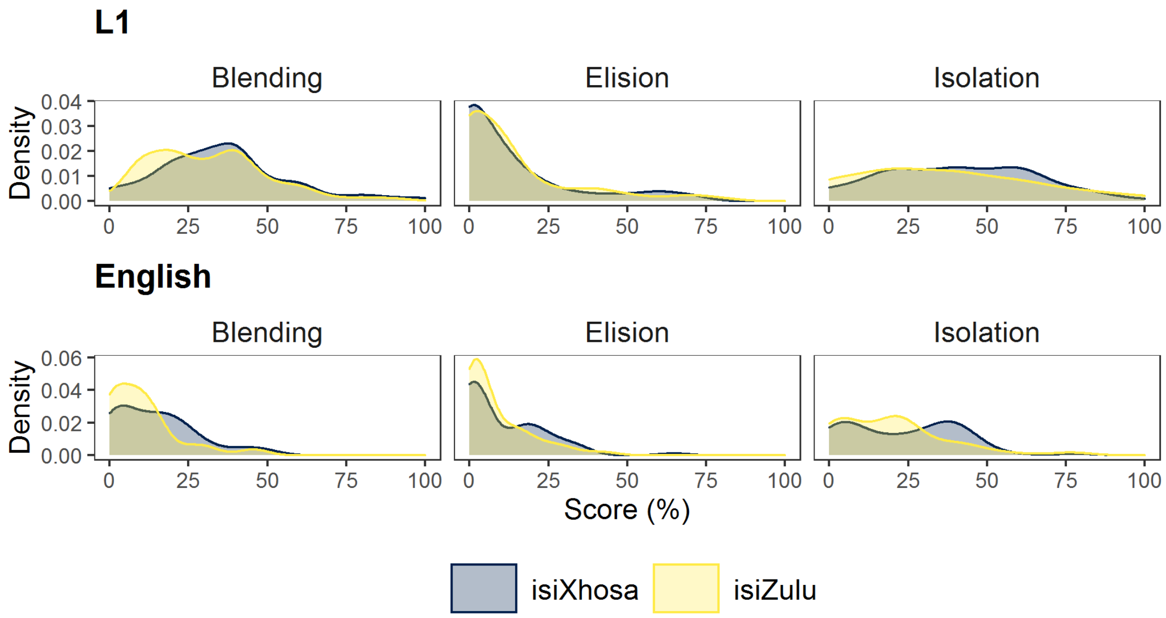

Figure 4-3. Density plots for PA tasks in L1 (top) and English (bottom) per language group in grade 1

4.3.1.4 *Phonological working memory (PWM)*

Figure 4-4 presents the distribution of scores in percentages for the PWM tasks. As seen in *Table 4-2*, performance on the forward digit span tasks did not differ between the language groups for the L1 task (isiXhosa M = 6, SD = 2; isiZulu M = 5, SD = 2, d = 0.4, 95%CI [0.0, 0.7]) or the English task (isiXhosa M = 13, SD = 3; isiZulu M = 13, SD = 3, d = 0.1, 95%CI [-0.3, 0.4]) since the confidence intervals overlapped with zero in both digit span tasks.

The confidence intervals for the effect of the difference between language groups was larger than zero for the NWR task in L1 (isiXhosa M = 8 SD = 3; isiZulu M = 6, SD = 3, d = 0.6, 95%CI [0.2; 0.9], t(133.8) = 3.4, p = .001, q = .001) and English (isiXhosa M = 15, SD = 3; isiZulu M = 12, SD = 3, d = 1.0, 95%CI [0.6; 1.3], t(133.9) = 5.5, p < .001, q < .001). This difference represents a medium and large effect respectively (Plonsky & Oswald, 2014). These effects are demonstrated clearly in *Figure 4-4* which shows that more children in the isiXhosa group performed higher in the NWR tasks (i.e., the distribution for the isiXhosa group overlaps less with the isiZulu group).

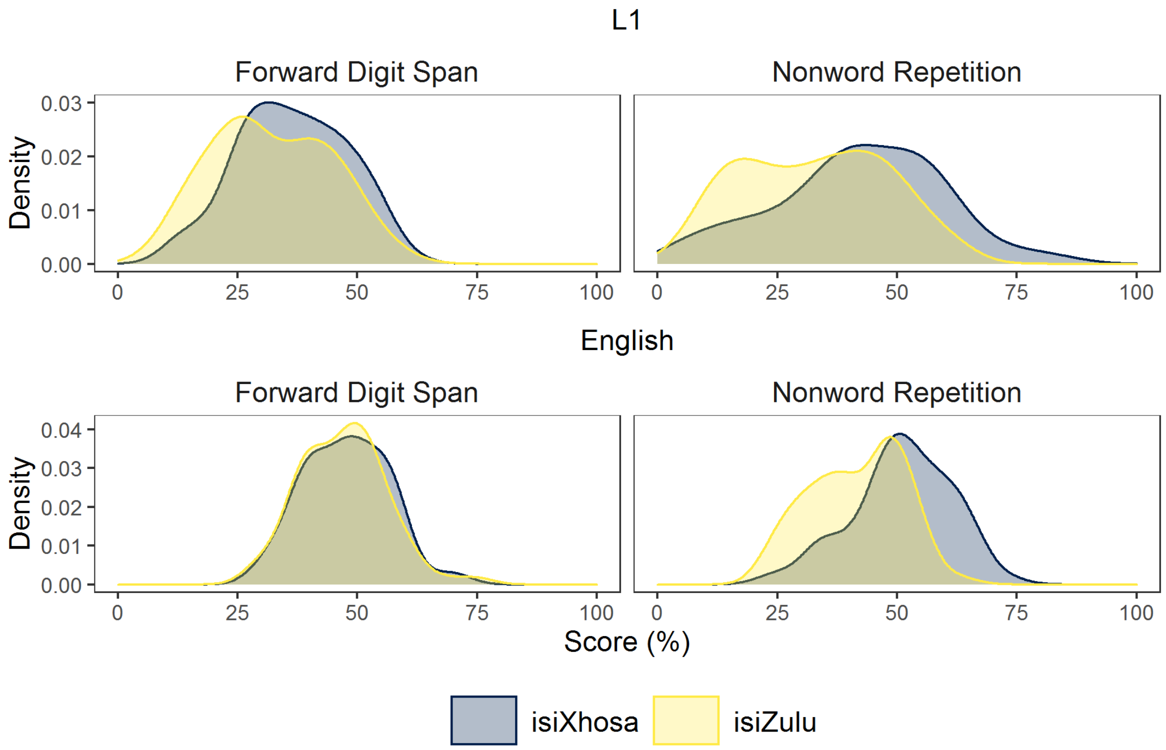

Figure 4-4. Density plots for digit span and NWR tasks in L1 (top) and English (bottom) per language group in grade 1

4.3.1.5 Rapid Automatised Naming

Figure 4-5 plots density curves for the RAN tasks per language group and language of administration. *Table 4-2* shows that the groups did not differ in the total time taken to name letters (isiXhosa M = 53, SD = 30; isiZulu M = 49, SD = 22; d = 0.2, 95%CI [-0.3; 0.6]) or objects (isiXhosa M = 56, SD = 13; isiZulu M = 55, SD = 12; d = 0.1, 95%CI [-0.2; 0.5] in L1. However, more isiXhosa (n = 53) than isiZulu (n = 40) participants completed the letter naming task. The letter naming task was not administered if participants could not identify five of the six practice letters. There was also no between-groups difference for digit naming in English (isiXhosa M = 47, SD = 16; isiZulu M = 47, SD = 18; d = 0.0, 95%CI [-0.3; 0.4]).

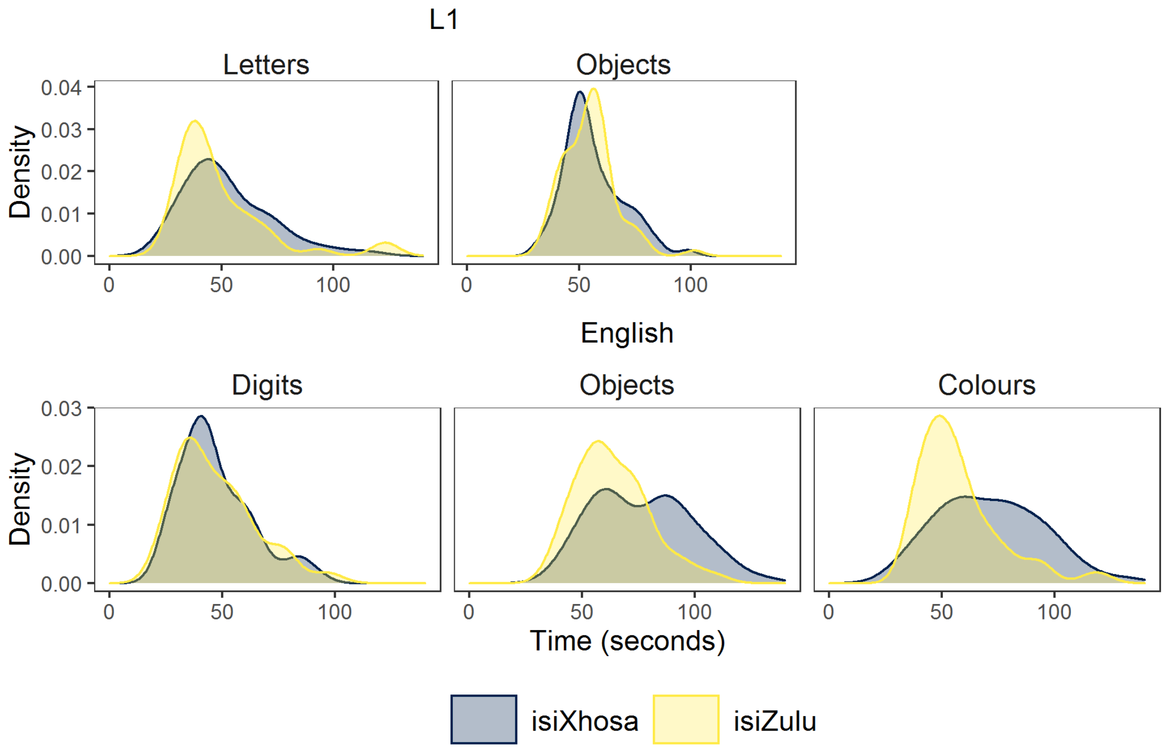

Figure 4-5. Density plots for RAN tasks in L1 (top) and English (bottom) per language group in grade 1

The isiZulu group named English objects (isiXhosa M = 77, SD = 22; isiZulu M = 64, SD = 16; d = 0.7, 95%CI [0.3; 1.1], t(109.4) = 3.8, p = <.001, q < .001) and English colours (isiXhosa M = 71, SD = 23; isiZulu M = 57, SD = 18; d = 0.7, 95%CI [0.3; 1.1], t(94.8) = 3.6, p < .001, q < .001) faster than the isiXhosa group. This represented a medium effect size for both tasks although the wide confidence interval indicates the effect could be from small to large. More isiZulu (n = 65) than isiXhosa (n = 51) participants completed the English colour naming task. The colour naming task was not administered if participants could not identify at least five of the six colours presented in the practice trial.

The effect size of within-subjects differences in naming speed by language of administration per task type was also calculated (*Table 4-4*). *Table 4-4* shows that there was no difference in scores between alphanumeric RAN (letters; isiXhosa M = 53, SD = 20; isiZulu M = 49, SD = 22) and non-alphanumeric RAN (objects; isiXhosa M = 56, SD = 13; isiZulu M = 55, SD = 12) in L1 (isiXhosa d = -0.2; isiZulu d = -0.3). However, for the English tasks, digits (isiXhosa M = 47, SD = 16; isiZulu M = 47, SD = 18) were named faster than objects (isiXhosa M = 77, SD = 22, d = 1.6; isiZulu M = 64, SD = 16, d = 1.0) and colours (isiXhosa M = 71, SD = 23, d = 1.2; isiZulu M = 57, SD = 18, d = 0.6). The effect size was larger for the isiXhosa than the isiZulu group (*Table 4-4*). There was no difference in naming speed for the colour (isiXhosa M = 71, SD = 23; isiZulu M = 57, SD = 18) and object (isiXhosa M = 77, SD = 22; isiZulu M = 64, SD = 16) naming tasks in English (isiXhosa d = -0.2; isiZulu d = -0.3). There was also no difference in naming speed between the alphanumeric tasks in L1 (letters; isiXhosa M = 53, SD = 20; isiZulu M = 49, SD = 22) and English (digits; isiXhosa M = 47, SD = 16, d = -0.3; isiZulu M = 47, SD = 18, d = -0.1).

Table 4-4. Within-subjects effect sizes (Cohen's d) with 95% confidence interval for RAN comparing language of administration and task types per language group in grade 1

Variables Compared		**isiXhosa** d [95% CI]	**isiXhosa** Effect	**isiZulu** d [95% CI]	**isiZulu** Effect	**Description**
L1 letters	L1 objects	-0.2 [-0.6; 0.1]	none	-0.3 [-0.7; 0.1]	none	
L1 letters	Eng digits	-0.3 [-0.7; 0.1]	none	-0.1 [-0.5; 0.3]	none	
L1 letters	Eng objects	-1.2 [-1.6; -0.8]	**medium -to-large**	-0.8 [-1.2; -0.3]	**small-to-medium**	Letters faster than Eng objects.
L1 letters	Eng colours	0.9 [0.4; 1.3]	**medium**	0.4 [0.0; 0.8]	none	Letters faster than Eng colours for isiXhosa group only.
L1 objects	Eng objects	1.2 [0.8; 1.6]	**large**	0.6 [0.3; 1.0]	**small**	Objects faster in L1 than English.
Eng digits	Eng objects	1.6 [2.0; 1.2]	**large**	1.0 [1.4; 0.6]	**medium**	Digits faster than objects in English.
Eng digits	Eng colours	1.2 [0.8; 1.7]	**medium -to-large**	0.6 [0.2; 0.9]	**small**	Digits faster than colours in English.
Eng objects	Eng colours	-0.2 [-0.6; 0.1]	none	-0.3 [-0.7; 0.0]	none	

Notes: Effect size interpretations used from Plonsky and Oswald (2014).

4.3.1.6 *Reading*

The distribution of the scores for the reading variables is presented in *Figure 4-6*. Each data point is represented in blue (isiXhosa) and yellow (isiZulu). *Table 4-2* shows that the 95% CI of the effect of the difference between the isiXhosa and isiZulu group overlapped with zero with narrower confidence intervals for all the reading variables. Although the two groups do differ slightly in their mean scores, this difference between groups could be zero in the population. Since effect size difference on the reading tasks did not differ, the mean and standard errors have been calculated for the entire sample (in red) except for L1 LRF which are calculated for each group. The distribution of scores is shown per group for LRF to demonstrate that only three participants per group scored above the 40 letters correct per minute grade 1 benchmark (Ardington, Wills, Pretorius, et al., 2021). The mean letters correct per minute for the LRF task was 16 (SD = 13) and 13 (SD = 12) for the isiXhosa and isiZulu groups respectively (*Figure 4-6*(a)), which was consistent with an effect size which overlapped with zero (d = 0.2, 95%CI [-0.2; 0.5]). Six percent of the isiXhosa group and 10% of the isiZulu group scored zero for the LRF task.

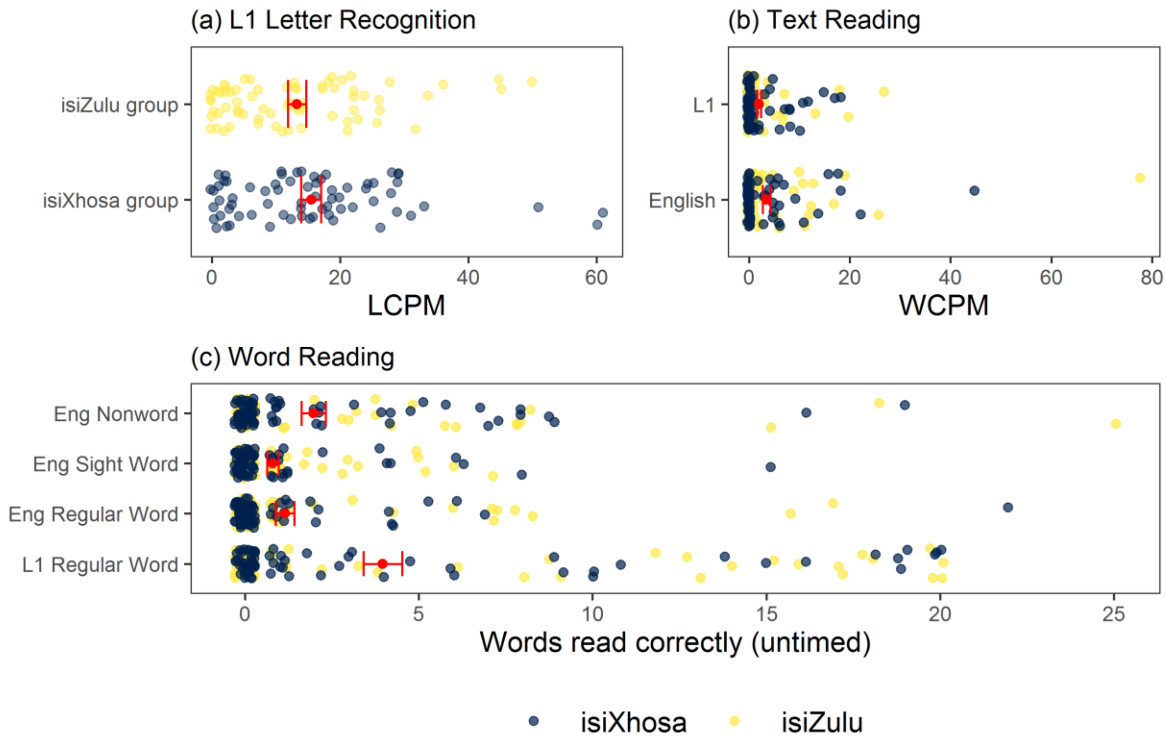

Figure 4-6. Distribution of (a) L1 LRF, (b) text reading and (c) word reading in grade 1 per language group and language of task administration with mean and standard error bars for the whole sample indicated in red

The word reading tasks were untimed, so the scores represent how many words were read correctly before the stop criterion of five consecutive errors was applied. The isiXhosa and isiZulu groups had the same means and standard deviations for all four reading tasks: L1 regular word reading (M = 4, SD = 7), English regular word reading (M = 1, SD = 3), English sight word reading (M = 1, SD = 2) and English nonword reading (M = 2, SD = 4) (*Table 4-2*). The large standard deviations and the clustering of points near zero in *Figure 4-6*(c) indicate floor effects. Indeed, more than half the participants scored zero for L1 regular word reading, and more than 70% of participants scored zero for the English word reading tasks (the exception was the isiXhosa group for English nonword reading where 57% received zero). Thus, the groups include a large proportion of non-readers.

With regard to the L1 oral reading fluency task, the groups performed similarly with a mean of 2 (isiXhosa SD = 4; isiZulu SD = 5) words read correctly in a minute. The isiZulu group had a higher standard deviation since the maximum score is 27 compared to 18 in the isiXhosa group. More than 60% of participants could not read one word correctly. About the same number of participants could not read in English for the isiXhosa group, but in isiZulu just over 50% of participants could not read an English word. The isiZulu group (M = 4, SD = 10) read one word more (on average) than the isiXhosa group (M = 3, SD = 7) in English. The oral reading fluency scores for L1 and English should not be directly compared because of the differences in word length in each language.

4.3.1.7 Spelling

The spelling task was scored in two ways. Firstly, dummy scoring was used to indicate whether the word was spelled completely correctly or not. *Table 4-2* shows that 27% of the isiXhosa group and 17% of the isiZulu group were able to spell "imoto" (car) in L1, and 38% of the isiXhosa group and 17% of the isiZulu group could spell "dog" in English. Since the children may be in different phases of spelling acquisition, partial scoring was also used which allocated a point for each letter that co-occurred in the correct place (see chapter 3 section 3.7.1.7 for more detail). The distribution of these scores using partial scoring is presented in *Figure 4-7*. The effect size in the difference between groups overlapped with zero for both L1 (isiXhosa M = 3, SD = 2; isiZulu M = 2, SD = 2; d = 0.3 95%CI [-0.1; 0.6]) and English (isiXhosa M = 1, SD = 2; isiZulu M = 1, SD = 2; d = 0.1 95%CI [-0.3; 0.4]) spelling (*Table 4-2*). Even when partial scoring was used 12% of the isiXhosa and 20% of the isiZulu group scored zero for the L1 task. In terms of the English spelling task, 62% of the isiXhosa learners scored zero, while 71% of the learners in isiZulu group scored zero.

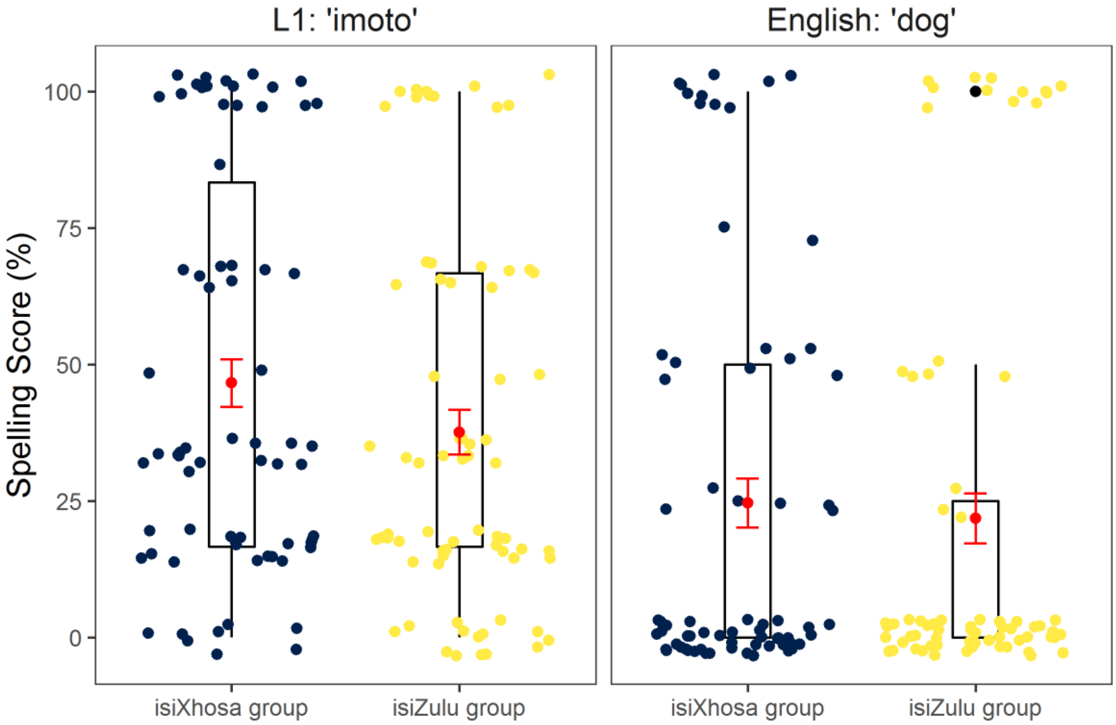

Figure 4-7. Boxplots with individual data points indicating the distribution of scores for the spelling tasks in L1 (left) and English (right) per language group with the mean and standard error (red) in grade 1

4.3.1.8 Descriptive statistics: summary

The results of the isiXhosa and isiZulu groups were compared for the L1 and English variables. This analysis showed that the effect sizes did not overlap with zero for vocabulary (isiXhosa group had a larger L1 and smaller English vocabulary than the isiZulu group), NWR in both languages (the isiXhosa group had higher scores on both tasks), RAN objects in English (the isiZulu group was faster than the isiXhosa group) and RAN colours (the isiZulu group was faster than isiXhosa group). For all the other variables (PA, forward digit span, reading, spelling, RAN objects, RAN digits, RAN letters) the effect size of the group difference (calculated with Cohen's d) overlapped with zero, suggesting that the difference between the groups is not practically significant. Lastly, the sample included a large number of non-readers and non-writers with many children unable to read a word correctly or spell a word correctly towards the end of grade 1. Even with the easier tasks (name writing and partial spelling scores) about 10-20% of the sample were non-readers/non-writers.

4.3.2 Correlations between variables within and across-languages per group

Given that there were some differences between the groups, this section presents the correlations per language group. The within language correlations are presented first for L1 (*Table 4-5*) then English (*Table 4-6*). The final two sections address the cross-language correlations for the isiXhosa (*Table 4-7*) and isiZulu (*Table 4-8*) groups. For use with interpretation, I use the suggested effect sizes of Plonsky and Oswald (2014) (descriptions in brackets are my alternate word choices) which are that r = .25 is a small (weak) effect, r = .40 is a medium (moderate) effect, and r = .60 is a large (moderately strong) effect. I interpret r = .80 as very strong.

4.3.2.1 L1 within-language correlations

In *Table 4-5*, Pearson correlations for the isiXhosa group are presented below the diagonal, whereas correlations for the isiZulu group are presented above the diagonal. The correlations between the phonological processing tasks in the L1 were similar for both language groups. The associations between the PA tasks ranged from r = .30 to r = .64. NWR and digit span had weak correlations (r = .22 - .35). The RAN tasks were correlated at r = .38. The correlations between the phonological processing and literacy tasks ranged from weak to moderately strong with slightly stronger correlations in the isiZulu group; correlations ranged from .20 to .63 in the isiXhosa group, and from .21 to .73 in the isiZulu group. The correlations between the literacy variables were similar in each group and ranged from moderately strong (.61) to strong (.89). Early literacy (name writing) and vocabulary correlated weakly with all other variables in both language groups.

Table 4-5. Pearson correlations between variables measured in L1 for the isiXhosa (below diagonal) and isiZulu (above diagonal) groups in grade 1

	Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	**Name Writing**	-	.24	.31 **	.33 **	.32 **	.43 ***	.30 *	-.17	.12	.38 **	.33 **	.21	.27 *	.37 **
2	**Vocabulary**	.39 ***	-	.29 *	.27 *	.38 **	.04	.33 **	-.34 *	-.18	.36 **	.37 **	.26 *	.37 **	.48 ***
3	**PA: Blending**	.23	.24 *	-	.53 ***	.64 ***	.32 **	.24 *	-.52 ***	-.29 *	.69 ***	.62 ***	.47 ***	.62 ***	.70 ***
4	**PA: Elision**	.32 **	.20	.60 ***	-	.55 ***	.33 **	.38 **	-.45 **	-.24 *	.69 ***	.73 ***	.71 ***	.65 ***	.52 ***
5	**PA: Isolation**	.35 **	.23	.33 **	.33 **	-	.39 ***	.34 **	-.53 ***	-.23	.7 ***	.59 ***	.42 ***	.53 ***	.60 ***
6	**PWM: Digit Span**	.36 **	.26	.33 **	.38 **	.17	-	.35 **	-.26	.02	.34 **	.41 ***	.33 **	.32 **	.35 **
7	**PWM: Nonword Repetition**	.28 *	.25 *	.19	.26 *	.00	.22	-	-.32	-.10	.37 **	.33 **	.31 **	.41 ***	.37 **
8	**RAN: Letters**	-.10	-.28	-.47 ***	-.28	-.02	-.07	-.06	-	.38 *	-.61 ***	-.44 **	-.35 *	-.41 **	-.33 *
9	**RAN: Objects**	.07	.03	-.17	-.09	.08	-.14	-.11	.38 **	-	-.33 **	-.23	-.14	-.17	-.29 *
10	**Literacy: LRF**	.43 ***	.33 **	.63 ***	.59 ***	.39 **	.31 *	.29 *	-.66 ***	-.29 *	-	.78 ***	.71 ***	.68 ***	.73 ***
11	**Literacy: Word Reading**	.37 **	.38 **	.63 ***	.56 ***	.28 *	.34 **	.25 *	-.46 ***	-.08	.75 ***	-	.75 ***	.80 ***	.75 ***
12	**Literacy: Text Reading**	.31 **	.33 **	.56 ***	.55 ***	.34 **	.27 *	.14	-.42 **	-.11	.69 ***	.89 ***	-	.69 ***	.43 ***
13	**Literacy: Can spell 'imoto'**	.36 **	.38 **	.53 ***	.47 ***	.31 **	.39 **	.22	-.39 **	.01	.61 ***	.85 ***	.69 ***	-	.74 ***
14	**Literacy: Spelling**	.42 **	.43 ***	.52 ***	.54 ***	.46 ***	.39 **	.20	-.43 **	.01	.64 ***	.71 ***	.58 ***	.82 ***	-

Notes: * p < .05; ** p < .01; *** p < .001. The p values have not been adjusted for multiple comparisons.

4.3.2.2 English within-language correlations

The English within-language correlations are presented in *Table 4-6*. The correlations for the isiXhosa group are presented below the diagonal and for the isiZulu group above the diagonal.

The PA tasks were moderately correlated with one another (r > .5) in both languages. Digit span and NWR were weakly correlated (isiXhosa r = .33, isiZulu r = .28). The RAN tasks had moderate to strong correlations with one another in each language group (r > .4). RAN and PWM were not associated with one another. The literacy variables had moderate to very strong correlations with one another (r = .41 - .92).

In both language groups, the correlations between the literacy variables and PA variables were moderate to moderately strong (r = .35 - .68). Regarding PWM, only digit span in the isiZulu group had significant and weak correlations with the literacy variables (r =.28 - .43). Associations between NWR and digit span and literacy measures were weak (below .30) in the isiXhosa group. Similarly, the NWR-literacy correlations were weak (below .26) in the isiZulu group.

The RAN and literacy correlations also differed by group. For the isiXhosa group, English RAN objects and colours had very weak and non-significant correlations with literacy (above -.25), and RAN digits had a weak correlation with only some of the literacy variables (-.34 and above). On the other hand, for the isiZulu group RAN digits and RAN objects had weak and significant correlations with literacy (between -.27 and -.44). Likewise, RAN colours was also weakly correlated (above -.27) with English literacy.

English vocabulary was weakly (r < .30) and, for the most part, non-significantly, associated with the phonological processing and literacy variables in both groups. Two exceptions to this pattern were found: PA was significantly (but still weakly) associated with vocabulary in both groups (r = .25 and r = - .44), and RAN objects was significantly (but weakly, r = .29) associated with vocabulary in the isiXhosa group (i.e., children with better English vocabulary in the isiXhosa group named English objects faster).

Table 4-6. Pearson correlations between variables measured in English for the isiXhosa (below diagonal) and isiZulu (above diagonal) groups in grade 1

	Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	**Vocabulary**	-	.27 *	.28 *	.17	.13	-.05	-.09	-.05	-.24	.15	.07	.16	.13	.23	.27 *
2	**PA: Blending**	.25 *	-	.62 ***	.67 ***	.32 **	.27 *	-.35 **	-.28 *	-.37 **	.39 ***	.42 ***	.33 **	.29 *	.32 **	.41 ***
3	**PA: Elision**	.26 *	.53 ***	-	.62 ***	.32 **	.16	-.26 *	-.38 **	-.43 ***	.68 ***	.48 ***	.64 ***	.63 ***	.55 ***	.61 ***
4	**PA: Isolation**	.42 ***	.67 ***	.64 ***	-	.37 **	.18	-.44 ***	-.5 ***	-.52 ***	.59 ***	.47 ***	.50 ***	.49 ***	.52 ***	.57 ***
5	**PWM: Digit Span**	.11	.23	.36 **	.42 ***	-	.28 *	-.18	-.26 *	-.25	.33 **	.31 **	.34 **	.28 *	.39 ***	.43 ***
6	**PWM: NWR**	.23	.15	.34 **	.33 **	.33 **	-	-.09	-.10	-.04	.13	.13	.25 *	.12	.10	.13
7	**RAN: Colours**	-.14	-.33 *	-.19	-.13	.12	.08	-	.67 ***	.49 ***	-.23	-.22	-.17	-.19	-.20	-.23
8	**RAN: Digits**	-.15	-.35 **	-.30 *	-.45 ***	-.22	-.24	.73 ***	-	.53 ***	-.44 ***	-.39 **	-.39 **	-.36 **	-.34 **	-.39 **
9	**RAN: Objects**	-.29 *	-.18	-.17	-.24	-.26	-.03	.58 ***	.44 ***	-	-.41 **	-.27 *	-.40 **	-.30 *	-.37 **	-.38 **
10	**Literacy: NW**	.06	.65 ***	.51 ***	.58 ***	.21	.24	-.20	-.31 *	-.04	-	.72 ***	.81 ***	.90 ***	.70 ***	.72 ***
11	**Literacy: Reg**	.03	.53 ***	.35 **	.40 ***	.12	.12	-.19	-.21	-.12	.84 ***	-	.64 ***	.41 ***	.63 ***	.65 ***
12	**Literacy: SW**	.02	.52 ***	.44 ***	.43 ***	.16	.10	-.13	-.20	-.02	.84 ***	.92 ***	-	.70 ***	.74 ***	.76 ***
13	**Literacy: Text**	.02	.61 ***	.46 ***	.53 ***	.16	.17	-.21	-.29 *	-.11	.85 ***	.89 ***	.85 ***	-	.52 ***	.55 ***
14	**Literacy: spell 'dog'**	.12	.51 ***	.56 ***	.53 ***	.21	.16	-.16	-.29 *	-.03	.70 ***	.57 ***	.64 ***	.57 ***	-	.97 ***
15	**Literacy: Spelling**	.06	.65 ***	.61 ***	.68 ***	.28 *	.28 *	-.18	-.34 **	-.06	.75 ***	.53 ***	.60 ***	.62 ***	.84 ***	-

Notes: NWR – Nonword Repetition; NW – Nonword Reading; Reg – Regular Word Reading; SW – Sight Word Reading

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

The p values have not been adjusted for multiple comparisons.

4.3.2.3 Across-language correlations

The across-language correlations for the isiXhosa group are presented in *Table 4-7* and those for the isiZulu group are presented in *Table 4-8*. In these tables, the L1 variables are listed in the header row, and the English variables are listed in the first column. The across language correlations were similar in strength and direction for both language groups unless otherwise stated.

The PA tasks were weakly to strongly correlated with one another across languages (r ranged from .27 to .71). The PWM tasks had weak to moderate correlations across languages (r ranged from .19 to .51). The RAN tasks had weak to moderate correlations with one another (r ranged from .30 to .68).

The reading tasks had moderate to very strong correlations with one another (r ranged from .60 to 95). The spelling tasks were more moderately correlated (r around .60). English vocabulary did not have significant associations with other skills except for emergent literacy (name writing) and L1 PA isolation in the isiXhosa group, and emergent literacy (name writing) and L1 vocabulary in the isiZulu group. L1 vocabulary was weakly to moderately correlated with English PA and literacy in both language groups (r ranged from .2 to .5). L1 vocabulary was significantly related to the English RAN tasks for the isiZulu group only (i.e., children with higher L1 vocabulary named English digits, colours, and objects faster).

Table 4-7. Cross-language Pearson correlations between variables for the isiXhosa group in grade 1

L1	Name Writing	Vocabulary	PA: Blending	PA: Elision	PA: Isolation	PWM: Digit Span	PWM: Nonword Repetition	RAN: Letters	RAN: Objects	Literacy: LRF	Literacy: Reg Word	Literacy: Text	Literacy: spell 'imoto'	Literacy: Spelling
English														
Vocabulary	.26 *	.21	.08	.21	.25 *	.13	-.05	-.08	-.05	.10	.01	.01	.08	.13
PA: Blending	.49 ***	.38 *	.58 ***	.49 ***	.33 **	.33 **	.21	-.37 **	.05	.54 ***	.70 ***	.64 ***	.59 ***	.53 ***
PA: Elision	.40 ***	.35 *	.45 ***	.71 ***	.27 *	.36 **	.25 *	-.17	-.15	.55 ***	.55 ***	.50 ***	.49 ***	.47 ***
PA: Isolation	.53 ***	.56 ***	.58 ***	.61 ***	.55 ***	.40 **	.29 *	-.40 **	-.06	.66 ***	.65 ***	.57 ***	.65 ***	.73 ***
PWM: Digit Span	.35 **	.34 **	.31 *	.30 *	.15	.51 ***	.29 *	.02	-.03	.32 **	.23	.19	.27 *	.33 **
PWM: NWR	.27 *	.22	.17	.30 *	.14	.45 ***	.25 *	.12	-.14	.29 *	.21	.18	.25 *	.34 **
RAN: Colours	-.25	.10	-.07	-.13	-.17	-.02	-.05	.49 ***	.37 **	* -.33	-.19	-.19	-.14	.01
RAN: Digits	-.31 *	-.17	-.30 *	-.30 *	-.34 **	-.11	-.02	.59 ***	.49 ***	-.57 ***	-.36 **	-.34 **	-.31 *	-.37 **
RAN: Objects	-.16	.16	-.09	-.21	-.02	-.15	-.10	.40 **	.33 *	-.24	-.09	-.06	-.14	-.14
Literacy: NW	.38 **	.39 **	.40 ***	.46 ***	.23	.35 **	.32 **	-.35 *	-.11	.58 ***	.86 ***	.85 ***	.75 ***	.61 ***
Literacy: Reg	.23	.23	.19	.38 **	.15	.27 *	.25 *	-.23	-.11	.33 **	.63 ***	.73 ***	.48 ***	.39 ***
Literacy: SW	.26 *	.25 *	.28 *	.41 ***	.17	.21	.28 *	-.23	-.10	.39 **	.65 ***	.74 ***	.45 ***	.40 ***
Literacy: Text	.28 *	.30 *	.37 **	.47 ***	.28 *	.41 **	.18	-.34 *	-.14	.56 ***	.78 ***	.86 ***	.60 ***	.54 ***
Literacy: spell 'dog'	.30 *	.33 **	.49 ***	.51 ***	.23	.14	.23	-.36 **	-.15	.60 ***	.71 ***	.68 ***	.48 ***	.38 **
Literacy: Spelling	.42 ***	.42 ***	.61 ***	.56 ***	.31 *	.26 *	.31 *	-.46 ***	-.06	.70 ***	.83 ***	.71 ***	.69 ***	.61 ***

Notes: NWR – Nonword Repetition; NW – Nonword Reading; Reg – Regular Word Reading; SW – Sight Word Reading

* $p < .05$; ** $p < .01$; *** $p < .001$

The p values have not been adjusted for multiple comparisons.

Table 4-8. Cross-language Pearson correlations between variables for the isiZulu group in grade 1

L1	Name Writing	Vocabulary	PA: Blending	PA: Elision	PA: Isolation	PWM: Digit Span	PWM: Nonword Repetition	RAN: Letters	RAN: Objects	Literacy: LRF	Literacy: Reg	Literacy: Text	Literacy: spell 'imoto'	Literacy: Spelling
English														
Vocabulary	.26 *	.28 *	.01	.02	.18	.13	.19	.08	.1	.16	.07	.07	.04	.09
PA: Blending	.28 *	.31 **	.58 ***	.50 ***	.58 ***	.21	.3 *	-.43 **	-.34 **	.55 ***	.46 *	.28 ***	.42 ***	.51 ***
PA: Elision	.29 *	.37 **	.53 ***	.71 ***	.62 ***	.4 ***	.34 **	-.37 *	-.23	.64 ***	.70 ***	.58 ***	.48 ***	.51 ***
PA: Isolation	.36 **	.52 ***	.52 ***	.55 ***	.62 ***	.3 *	.39 ***	-.49 **	-.28 *	.67 ***	.69 ***	.48 ***	.66 ***	.65 ***
PWM: Digit Span	.39 ***	.2	.4 ***	.36 **	.25 *	.48 ***	.38 **	-.52 ***	-.18	.42 ***	.47 ***	.29 *	.45 ***	.46 ***
PWM: NWR	.21	-.12	.21	.28 *	.07	.25 *	.19	-.12	-.03	.13	.16	.14	.21	.17
RAN: Colours	-.27 *	-.37**	*** -.41	* -.26	** -.4	-.01	-.06	.68 ***	.36 **	-.42 ***	-.27 *	-.17	-.24	* -.28
RAN: Digits	-.31 **	-.44 ***	-.46 ***	-.4 ***	-.5 ***	-.17	-.3 *	.61 ***	.43 ***	-.67 ***	-.49 ***	-.4 ***	-.45 ***	-.54 ***
RAN: Objects	-.35 **	-.46 ***	-.29 *	-.42 **	-.33 *	.06	-.23	.41 *	.30 *	-.48 ***	-.44 ***	-.33 *	-.44 ***	-.42 ***
Literacy: NW	.25 *	.34 **	.51 ***	.73 ***	.52 ***	.36 **	.32 **	-.4 *	-.19	.73 ***	.82 ***	.95 ***	.75 ***	.50 ***
Literacy: Reg	.21	.37 **	.57 ***	.53 ***	.54 ***	.29 *	.36 **	-.36 *	-.14	.57 ***	.73 ***	.69 ***	.64 ***	.61 ***
Literacy: SW	.25 *	.23	.44 ***	.65 ***	.47 ***	.40 ***	.2	-.35 *	-.14	.60 ***	.81 ***	.74 ***	.66 ***	.51 ***
Literacy: Text	.18	.23	.4 ***	.66 ***	.39 ***	.31 **	.23	-.29	-.11	.64 ***	.65 ***	.88 ***	.63 ***	.30 *
Literacy: spell 'dog'	.27 *	.26 *	.46 ***	.53 ***	.5 ***	.38 **	.19	-.32	-.12	.53 ***	.78 ***	.53 ***	.60 ***	.54 ***
Literacy: Spelling	.32 **	.29 *	.54 ***	.57 ***	.55 ***	.42 ***	.24 *	-.33 *	-.17	.61 ***	.83 ***	.57 ***	.65 ***	.62 ***

Notes: NWR – Nonword Repetition; NW – Nonword Reading; Reg – Regular Word Reading; SW – Sight Word Reading

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

The p values have not been adjusted for multiple comparisons.

4.3.2.4 *Correlation analysis: summary*

In summary, the correlation analysis demonstrated that, for the most part, the relationships between variables were similar for the isiXhosa and isiZulu groups. As expected, the literacy measures were strongly associated within and across languages, and had expected correlations with PA. The phonological processing skills were also associated with one another as expected. The RAN objects measures were very weakly related to literacy measures, especially for the isiXhosa group. In some cases, the correlations were slightly stronger for the isiZulu than the isiXhosa group.

4.3.3 Confirmatory factor analysis

As indicated in the data analysis procedures (section 3.8.3.1), confirmatory factor analysis models were fit to the data to determine the bilingual dimensionality of each phonological processing construct. Dimensionality refers to whether a construct should be considered language general or language specific. First the model was fit to the data for the whole sample, then a multigroup CFA (MGCFA) was fit to determine whether the model fit each group simultaneously. The models were fit using the MLR estimator (maximum likelihood estimation with robust Huber-White standard errors) because of non-normal and some missing data. In R, the syntax, therefore, included *estimator* = *"MLR"* and *missing* = *"ML"*. The robust statistics are reported.

4.3.3.1 *Dimensionality of PA*

A two-factor (language specific) model (*Figure 4-8*a) and a one-factor (language general) model (*Figure 4-8*b) of the data were compared. Each model included residual correlations for the same tasks in each language, as done by Branum-Martin et al. (2015). While the fit of the language specific model was excellent, the language general model had a significant chi square test. The results of the two-factor model were: scaled χ^2 (5) = 2.531, p = .772, scaling factor = 0.976, robust CFI = 1.000, robust TLI = 1.018, robust RMSEA = 0, 90% CI [0; .079], SRMR = .011. The results of the one factor model were: scaled χ^2 (6) = 12.713, p = .048, scaling factor = 1.053, robust CFI = 0.982, robust TLI = 0.956, robust RMSEA = 0.092, 90% CI [.009; .163], SRMR = .025. The chi square difference test, which compared both models was significant, confirming that the two-factor (language specific) model was superior, $\Delta\chi^2$ = 7.589, Δdf = 1, p = .006. The latent correlation between L1 and English PA was .89 (*Figure 4-8*).

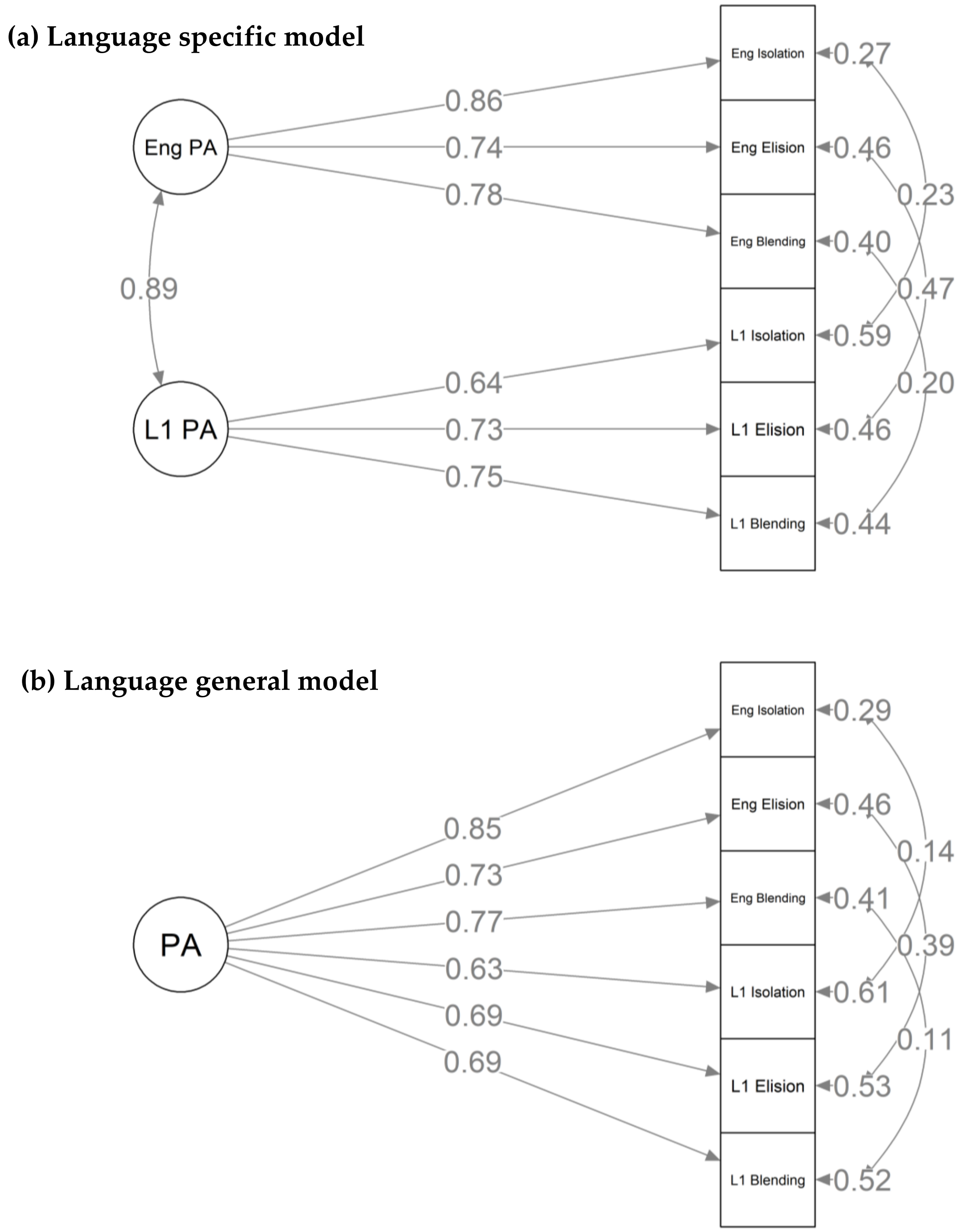

Figure 4-8. Language specific (a) and language general (b) models of PA in grade 1

Notes: (a) scaled χ^2 (5) = 2.532, p = .772, scaling factor = 0.976, robust CFI = 1.000, robust TLI = 1.018, robust RMSEA = 0, 90% CI [0; .079], SRMR = .011; (b) scaled χ^2 (6) = 12.713, p = .048, scaling factor = 1.053, robust CFI = 0.982, robust TLI = 0.956, robust RMSEA = 0.092, 90% CI [.009; .163], SRMR = .025

The language specific model was tested per language group using MGCFA. The configural model had excellent fit to the data, scaled χ^2 (10) = 4.066, p = .944, scaling factor = 0.940, robust CFI = 1.0, robust TLI = 1.041, robust RMSEA = 0.0, 90% CI [.0; .009], SRMR = .014. The weak model (factor loadings constrained to be equal) had acceptable fit, scaled χ^2 (14) = 13.865, p = .460, scaling factor = 1.076, robust CFI = 1.0, robust TLI = 1.001, robust RMSEA = 0.0, 90% CI [.0; .119], SRMR = .077. The chi-square difference test comparing the group models with unconstrained and constrained factor loadings was non-significant, indicating that the factor loadings are similar for both language groups, $\Delta\chi^2$ = 7.838, Δdf = 4, p = .098. The strong model (intercepts equal) also fit the data well and was not significantly different from the previous model, scaled χ^2 (18) = 18.221, p = .441, scaling factor = 1.067, robust CFI = 0.999, robust TLI = 0.999, robust RMSEA = 0.0, 90% CI [.0; .111], SRMR = .08, $\Delta\chi^2$ = 4.368, Δdf = 4, p = .359. The final model which constrained the latent correlations and latent means to be equal had a non-significant chi-square different test with the strong model, scaled χ^2 (21) = 21.302, p = .441, scaling factor = 1.084, robust CFI = 0.999, robust TLI = 0.999, robust RMSEA = 0.015, 90% CI [.0; .107], SRMR = .094, $\Delta\chi^2$ = 3.077, Δdf = 3, p = .3799. However, there was some misfit in the model because there was a high SRMR value.

In summary, these results indicate that, in grade 1, PA is best conceptualised as language specific rather than language general. The isiXhosa and isiZulu groups had similar factor loadings and intercepts. There was some evidence to indicate that PA levels and language relations were similar for the language groups, although there was some misfit in the final model. Inspection of previous models indicated that the L1-English PA latent correlation was slightly weaker in the isiXhosa group, and the isiXhosa group had slightly higher English PA compared to the isiZulu group.

4.3.3.2 Dimensionality of PWM

A series of models were fit to the PWM data based on the literature. These included a language specific model (L1 PWM and English PWM factors; *Figure 4-9*), and two language general models: task specific (NWR and Digit Span factors) and task general (one PWM factor). The literature was mixed about whether PWM should be considered task specific or task general. For example, there is some evidence that verbal and numerical tasks are related to reading with different strength (Peng et al., 2018), but there is also evidence that, before grade 4, verbal and numerical working memory tasks are similarly related to reading because PWM is domain general (In'nami et al., 2021).

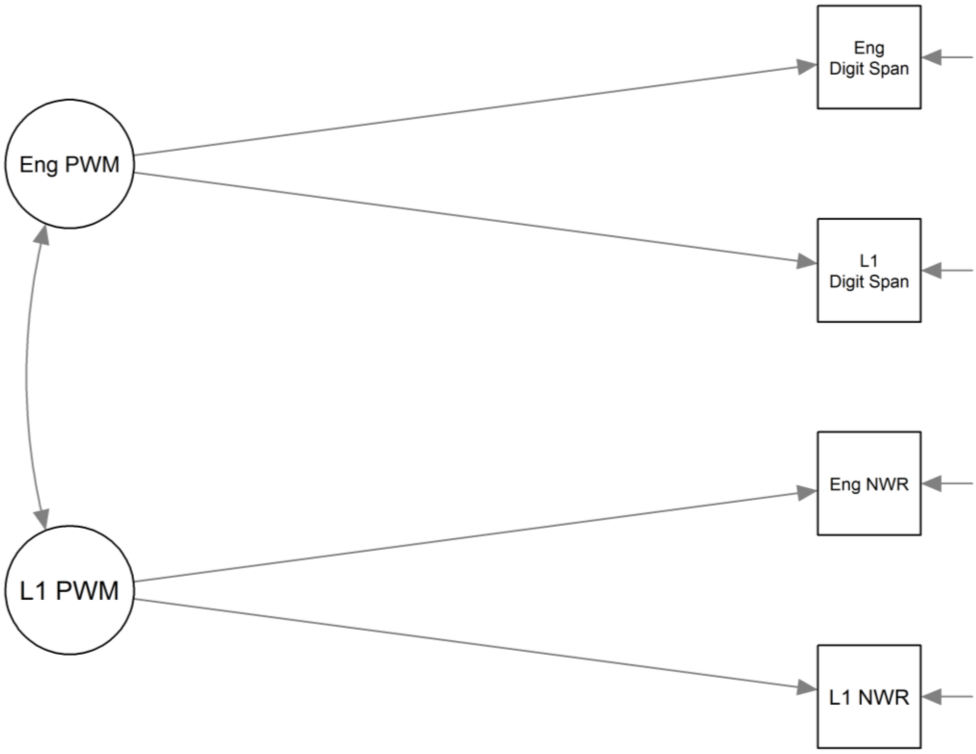

Figure 4-9. Language specific model of PWM in grade 1

The language specific model did not fit the data and returned an error message. The language general models had good fit to the data (*Figure 4-10*). The language general task specific model fit the data well for the whole sample, scaled χ^2 (1) = 0.694, p = .405, scaling factor = 0.957, robust CFI = 1.000, robust TLI = 1.022, robust RMSEA = 0.000, 90% CI [.0; .205], SRMR = .011. The language general task general model also fit the data well, scaled χ^2 (2) = 2.706, p = .258, scaling factor = 0.849, robust CFI = 0.993, robust TLI = 0.978, robust RMSEA = 0.046, 90% CI [.0; .169], SRMR = .024. The chi-square difference test between these two models was non-significant, $\Delta\chi^2$ = 2.205, Δdf = 1, p = .138, thus the model with more degrees of freedom (the one factor language general, task general model) is preferred.

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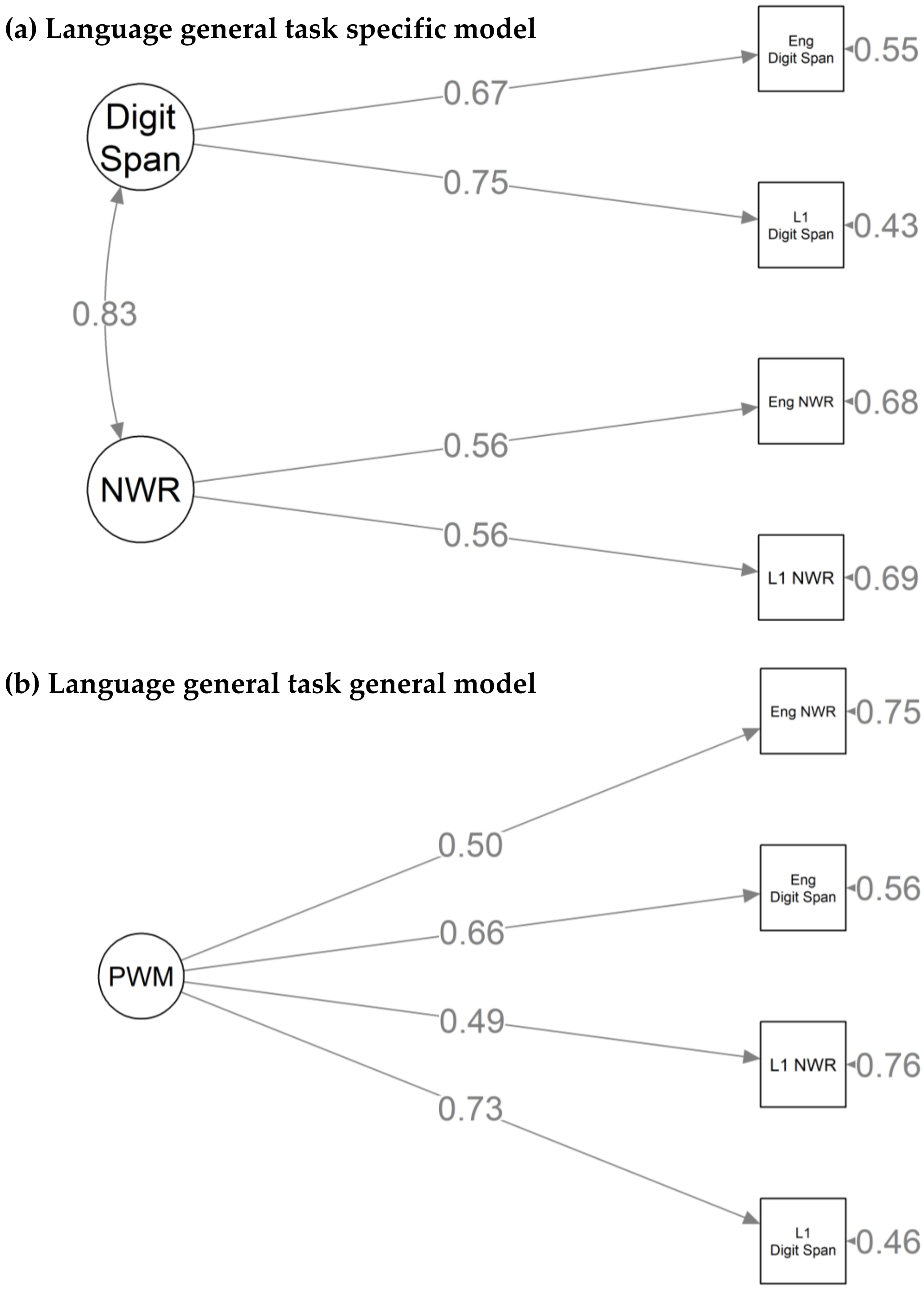


Figure 4-10. Language general models of PWM which are task-specific (a) and task general (b) in grade 1

Notes: (a) scaled χ^2 (1) = 0.694, p = .405, scaling factor = 0.957, robust CFI = 1.000, robust TLI = 1.022, robust RMSEA = 0.000, 90% CI [.0; .205], SRMR = .011; (b) scaled χ^2 (2) = 2.706, p = .258, scaling factor = 0.849, robust CFI = 0.993, robust TLI = 0.978, robust RMSEA = 0.046, 90% CI [.0; .169], SRMR = .024.

The one factor model was fit to the data for each group using MGCFA. The configural model (scaled χ^2 (4) = 1.200, p = .878, scaling factor = 1.000, robust CFI = 1.000, robust TLI = 1.119, robust RMSEA = 0.000, 90% CI [.0; .089], SRMR = .013) and weak model (scaled χ^2 (7) = 3.093, p = .876, scaling factor = 0.910, robust CFI = 1.000, robust TLI = 1.086, robust RMSEA = 0.000, 90% CI [.0; .070], SRMR = .040) had acceptable fit and were not significantly different from one another, $\Delta\chi^2$ = 2.045, Δdf = 3, p = .563. The strong model (residuals constrained to be equal) had poor fit to the data and was significantly different from the weak model, scaled χ^2 (10) = 35.964, p < .001, scaling factor = 0.821, robust CFI = 0.698, robust TLI = 0.637, robust RMSEA = 0.175, 90% CI [.116; .239], SRMR = .120, $\Delta\chi^2$ = 43.448, Δdf = 3, p < .001. Freeing the intercepts for L1 and English NWR improved the model fit and this model was not significantly different from the weak model, scaled χ^2 (8) = 4.642, p = .795, scaling factor = 0.913, robust CFI = 1.000, robust TLI = 1.065, robust RMSEA = 0.000, 90% CI [.000; .088], SRMR = .046, $\Delta\chi^2$ = 1.518, Δdf = 1, p = .218. The final model which constrained the residuals and the latent means to be equal between groups also had good fit to the data, and was not significantly different from the previous model, scaled χ^2 (13) = 10.216, p = .676, scaling factor = 0.915, robust CFI = 1.000, robust TLI = 1.065, robust RMSEA = 0.000, 90% CI [.000; .091], SRMR = .079, $\Delta\chi^2$ = 4.071, Δdf = 4, p = .397.

In summary, at the grade 1 timepoint, only the language general and task general model of PWM was supported for both the isiXhosa and isiZulu groups. Measurement invariance testing found that the groups were similar in all respects, except that the isiXhosa group had higher intercepts for L1 NWR and English NWR. Nevertheless, at the latent level, the mean of PWM did not differ significantly. In this final model, the NWR indicators loaded poorly ($\lambda < .50$) on the PWM factor indicating that they may not be good indicators of the PWM construct. Inspection of the correlation matrix revealed that the correlations between NWR and the literacy skills was also much weaker compared to the digit span and literacy correlations. The L1 digit span task had similar correlations for the isiXhosa and isiZulu groups with L1 literacy. However, the correlations between English digit span and English literacy were stronger for the isiZulu group. Therefore, the indicators for digit span in each language were used in the path analyses and the NWR tasks were not used in later analyses.

4.3.3.3 Dimensionality of RAN

In the CTOPP, RAN is theorised to consist of two latent factors, symbolic naming (letters and digits) and non-symbolic naming (colours and objects) (Wagner et al., 2013a). Only symbolic naming is assessed from 7 years old in the CTOPP. However, in my study, non-symbolic naming was included in the assessments because of the educational context where many children do not learn letters and numbers by the end of first grade. Because of this context, the same RAN tasks were not administered in L1 and English since the pilot showed that some items (e.g., digits and colours) were known primarily in English and not in the L1. This means that in some cases there was only one manifest variable to represent the latent variable. Nevertheless, some research shows that RAN measured in the language a child knows best is sufficient, i.e., RAN appears to be language general once items are recognised automatically (Gottardo et al., 2021).

In studies which include bilingual measures of RAN, researchers have assigned L1 RAN as one variable and L2 RAN as one variable without taking into account the RAN tasks. For example, Savage et al. (2018) in their study of English Kindergarteners in French immersion, used exploratory factor analysis to extract one English RAN factor and one French RAN factor from letter, digit, objects and colour RAN tasks in each language. Composite scores (averaging the naming times) have also been used to reduce the number of variables in analysis. For example, Manis et al. (2004) averaged the English object and digit naming tasks for one English RAN variable in their regression analysis. Nevertheless, the CTOPP clearly differentiates between alphanumeric (letters and digits) and non-alphanumeric (objects and colours) RAN because task type does affect the RAN-reading relationship. Finally, although it is possible to consider RAN (especially alphanumeric RAN) as language independent, I wanted to determine whether RAN was language specific in this study because (1) other studies have language specific RAN factors, and (2) non-alphanumeric RAN tasks are affected by language exposure (Gottardo et al., 2021).

In this analysis, I tested three models of RAN (*Figure 4-11*). Firstly, a language specific two factor model was tested. This model did not fit the data as the models estimated a latent correlation higher than 1 between L1 and English RAN. The second model was a language general task specific model (one factor for alphanumeric RAN and one factor for non-alphanumeric RAN), scaled χ^2 (4) = 5.261, p = .262, scaling factor = 1.029, robust CFI = 0.995, robust TLI = 0.987, robust RMSEA = 0.048, 90% CI [0.0; 0.146], SRMR = .023. The third model was a language and task general model (one RAN factor) which did not fit the data well, scaled χ^2 (5) = 20.775, p = .001, scaling factor = 0.919, robust CFI = 0.941, robust TLI = 0.882, robust RMSEA = 0.114, 90% CI [0.084; 0.211], SRMR = .047. In this sample at grade 1, the language general and task specific model (the second model in *Figure 4-11*) was supported.

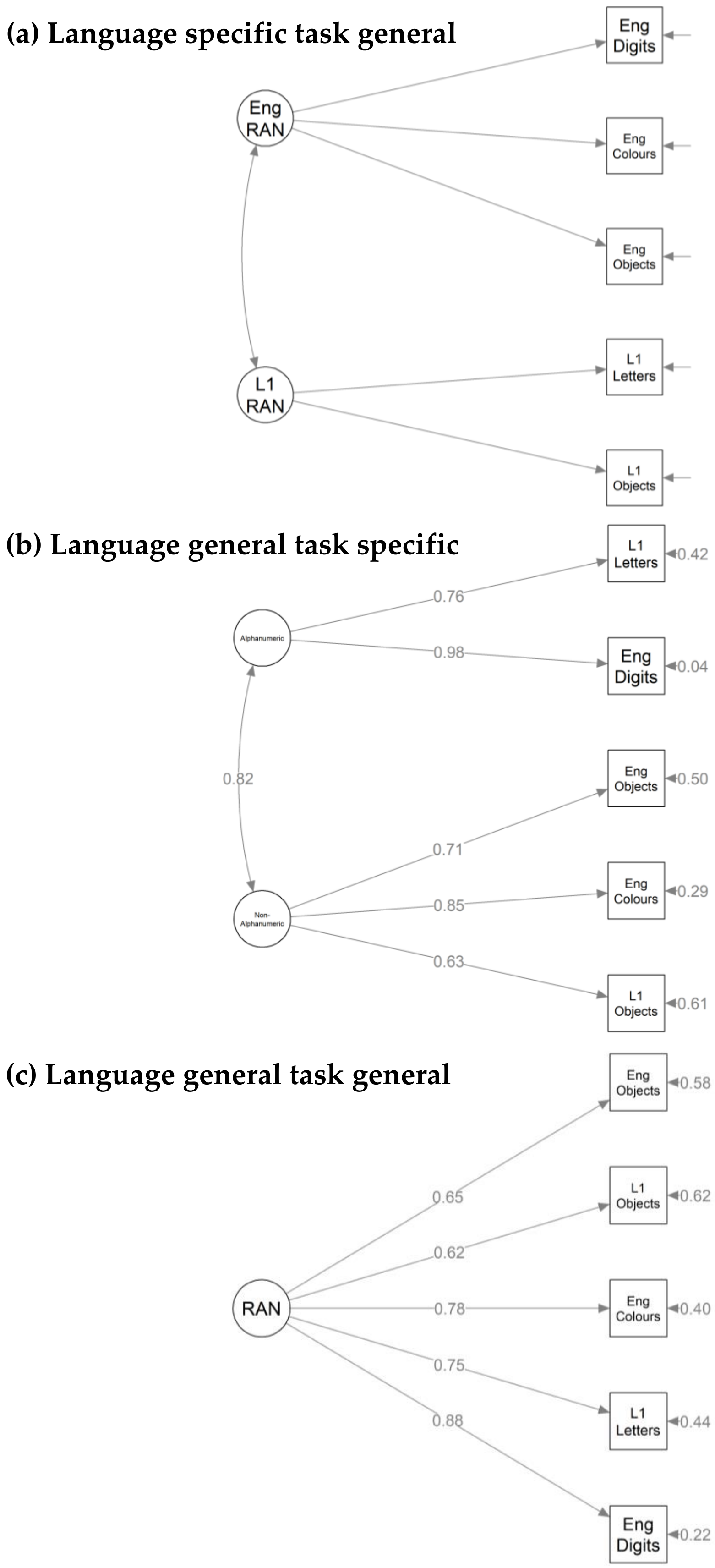


Figure 4-11. Models of RAN in grade 1

A MGCFA was fit to the language general and task specific model (*Figure 4-11* (b)). The model was supported at the configural level, scaled χ^2 (8) = 9.300, p = .318, scaling factor = 0.975, robust CFI = 0.995, robust TLI = 0.988, robust RMSEA = 0.048, 90% CI [0.0; 0.152], SRMR = .025. The model was also supported at the metric level (factor loadings constrained to be equal), scaled χ^2 (11) = 11.243, p = .423, scaling factor = 0.975, robust CFI = 0.999, robust TLI = 0.998, robust RMSEA = 0.018, 90% CI [0.0; 0.126], SRMR = .048, $\Delta\chi^2$ = 1.943, Δdf = 3, p = .584. Constraining the intercepts to be equal resulted in worse model fit, scaled χ^2 (14) = 20.707, p = .109, scaling factor = 0.965, robust CFI = 0.975, robust TLI = 0.964, robust RMSEA = 0.082, 90% CI [0.0; 0.151], SRMR = .074, $\Delta\chi^2$ = 9.712, Δdf = 3, p = .02. A partial strong model where the intercept of L1 RAN Objects was free to vary fit the data better, scaled χ^2 (13) = 11.765, p = .547, scaling factor = 0.975, robust CFI = 1.000, robust TLI = 1.007, robust RMSEA = 0.000, 90% CI [0.0; 0.108], SRMR = .049, $\Delta\chi^2$ = 0.512, Δdf = 2, p = .771. Constraining the residuals and latent correlation to be equal did not result in worse model fit, scaled χ^2 (19) = 12.841, p = .847, scaling factor = 0.965, robust CFI = 1.000, robust TLI = 1.024, robust RMSEA = 0.000, 90% CI [0.0; 0.059], SRMR = .066, $\Delta\chi^2$ = 0.9793, Δdf = 6, p = .986. The model where the latent means were constrained to be equal resulted in worse model fit, scaled $\chi 2$ (20) = 49.430, p < .001 scaling factor = 0.965, robust CFI = 0.889, robust TLI = 0.889, robust RMSEA = 0.144, 90% CI [0.095; 0.195], SRMR = .139, $\Delta\chi 2$ = 30.965, Δdf = 1, p < .001. The isiXhosa group had a lower mean on the non-alphanumeric latent variable because they were overall slower to name English items.

For the path analyses I decided to use the indicators for L1 RAN objects and English RAN digits because of missing data in the other RAN tasks at this time point (and discussed in section 4.3.1.5). Children who could not automatically recognise the items in the practice round were not administered the tasks. This choice should reveal similar results as using all available tasks since language general models fit the RAN data in the confirmatory factor analysis models.

4.3.3.4 Summary: Confirmatory factor analysis

MGCFA models were fit to the data per phonological processing construct to determine whether the data fit a language general or language specific model better. PA was best conceptualised as two closely related language specific factors. RAN and PWM were best conceptualised as language general. Thus, for the path analysis, a L1 PA, and English PA variable were used (and derived from principal components analysis). RAN scores were affected by familiarity with the items in each language. The RAN letters, English RAN objects and RAN colours had missing data because some participants did not know these items due to instruction and/or language familiarity. Because RAN was language general, one alphanumeric task (English RAN digits) and one non-alphanumeric task (L1 RAN Objects) was used in the path analysis. This ensured more observations could be included in the analysis. With regards to PWM, NWR had low loadings on the genera PWM factor, and was weakly related to literacy outcomes possibly due to measurement issues with the NWR task. For this reason, the digit span scores in each language were used in the later analysis. Although PWM was found to be language general, the correlations between digit span and literacy were affected by language group, with the isiXhosa group having higher correlations for L1 digit span, and the isiZulu group having higher correlations for English digit span.

4.3.4 Path analysis

Multigroup path analysis models were fit to the reading and spelling data using observed variables to represent each construct with the exception of L1 and English PA, and L1 and English reading. I used principal components analysis on the L1 PA, English PA, L1 reading and English reading tasks to reduce the number of variables in the path analysis. The blending, elision and isolation tasks were included in the principal component analysis per language. The reading constructs included word and text reading per language. I used the tasks for L1 RAN objects and English RAN digits as observed variables because these were completed by the greatest number of participants. Many children were unable to complete the RAN letters, and English Colours and Objects tasks because of the social and educational context. I used the tasks for L1 digit span and English digit span as observed variables as well. The NWR tasks had low loadings on the PWM factor and, based on my own experience administering and scoring recordings of the tasks, were more difficult to score correctly because of noise at each school. L1 and English vocabulary, LRF, and L1 and English spelling were included as observed variables as they were measured with one task only. The partial scores were used for spelling as they had more variation. All observed variables were transformed into z-scores so they would be on the same scale as the scores derived from the principal components analysis. Two path analyses were fit to the data: one for reading fluency and one for spelling. Both models included LRF as a mediator between the phonological processing and vocabulary variables and the literacy variables. Thus, it was possible to determine whether the effect of phonological processing skills on literacy is because they influence LRF which then influences reading and spelling, or whether the phonological processing skills exerted an effect on reading and spelling after controlling for their effect on LRF. The direct, indirect, and total effects of the predictors on the outcomes were also calculated. The use of a multigroup path model allowed me to test whether the relations between phonological processing and literacy are the same for the isiXhosa and isiZulu groups.

The path models were estimated using lavaan (Rosseel, 2012), with the MLR estimator (maximum likelihood estimation with robust (Huber-White) standard errors) to address some non-normality in the data. Rather than remove cases with missing data listwise, the full information maximum likelihood function was used so that data would be used case wise (by setting *missing* to "ML" in the *sem* function). One participant who had scores above 3 SD on the reading variables was excluded because they were an outlier, so 138 cases were available for analysis.

First, a configural model was fit to the data to determine whether the same model fit both the isiXhosa and isiZulu data. In the configural model, the same paths are included but all values are free to vary. In a path model (e.g., *Figure 4-12*), each path is an estimated regression between variables. Misfit in the model at this stage indicates that some regressions are not being estimated correctly so modification indices can be checked to identify which paths need to be specified in the model. Second, the correlations (not shown in the figures) between the variables was constrained to be equal, thus, answering the question: are the predictor variables similarly associated with one another in the isiXhosa and isiZulu groups? This model with constrained correlations is compared to the configural model. If the chi-square test is significant, this indicates that at least one correlation is not the same in each group. Modification indices are used to identify the misfit and the model is refit with the correlation left free to vary. Third, the regressions (the paths) were constrained to be equal. This model answers the questions: are the strength and direction of the associations between predictors and outcomes similar for the isiXhosa and isiZulu groups? This model with constrained regressions is compared to the second model with constrained correlations. If the chi-square test is significant, this indicates that at least one regression is not the same in each group. Modification indices are used to identify the misfit and the model is refit with the regression left free to vary. In this way, one can identify which paths are markedly different for each group. Should the relationship between phonological processing and literacy skills not differ between groups, we would expect a non-significant chi-square test once the regressions are constrained to be equal.

The results are presented graphically in a path diagram, and the regressions are presented in tables. The rectangles represent observed variables. In these path diagrams, solid lines represent statistically significant paths. A black solid line indicates a statistically significant positive regression, and a red solid line indicates a statistically significant negative regression. Dotted/broken lines indicate paths that were estimated that were not significant. No lines between variables indicates that no association was estimated between these variables. The direct, indirect, and total effects of each variable on the literacy outcomes is presented in the tables. Direct effects are the estimated regressions directly from the predictor and outcome variable. An indirect effect is the product of the regressions of the predictor variable via the mediator, and the mediator's direct effect on the outcome. For example, imagine that

L1 PA and LRF have a direct effect on reading fluency, and L1 PA also has a direct effect on LRF. In this case, LRF is a mediator between L1 PA and reding fluency. Not only does L1 PA directly influence reading fluency, but it also has an indirect via the mediator (LRF). To calculate the indirect effect of L1 PA on L1 reading fluency via the mediator (LRF), one must multiply the regression coefficient of L1 PA – LRF and the regression coefficient of LRF – reading fluency. Finally, the total effect is the sum of the direct effect plus the indirect effect. The total effect of a predictor is the full effect of the predictor on the outcome after accounting for its influence on the mediator variable.

4.3.4.1 Path analysis for reading fluency

A multigroup path model was fit to the data predicting L1 and English reading fluency, with letter-sound fluency as a mediator. The model included direct paths from the exogenous (predictor) variables to LRF. Direct paths to L1 and English reading were included for the two PA variables and the two RAN variables. Inspection of the residuals of this first configural model revealed that a direct path from English vocabulary to L1 reading would improve model fit and, therefore, a direct path from English vocabulary to L1 reading was inserted. The final model is presented in *Figure 4-12*.

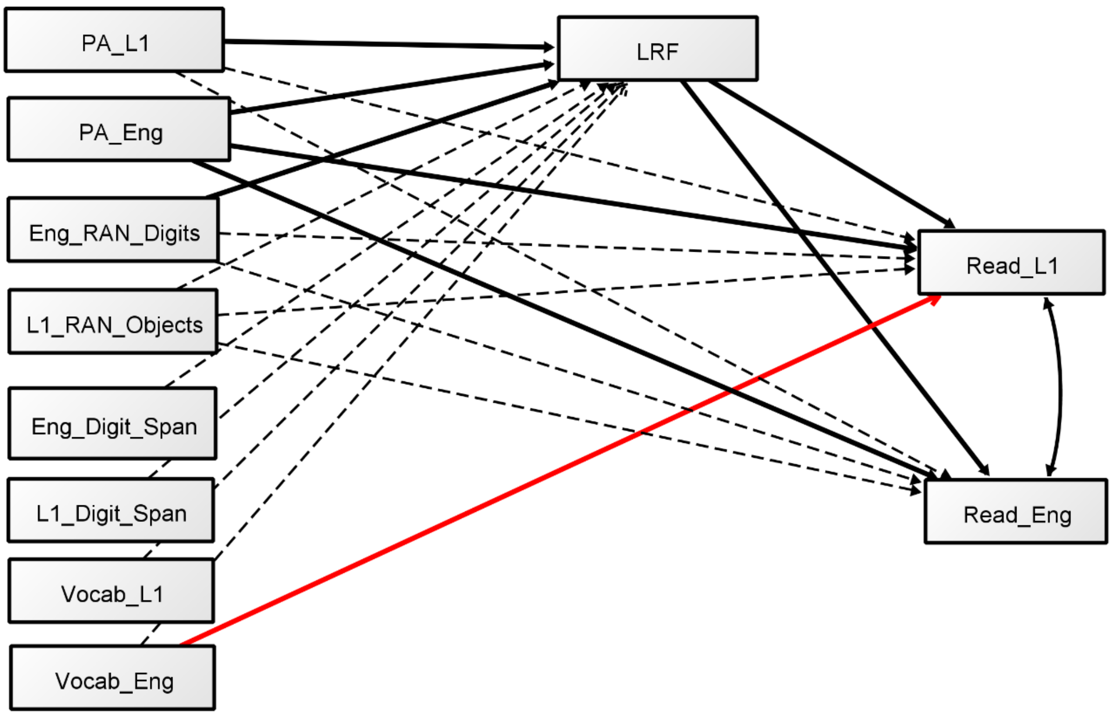


Figure 4-12. Path diagram of predictors of reading fluency in grade 1

Notes: Solid paths represent significant positive regressions. Solid red paths represent significant negative regressions. Broken lines represent non-significant regressions.

The configural model fit the data well, scaled χ^2 (22) 24.009, p = .347, scaling factor = 0.938, robust CFI = 0.998, robust TLI = 0.988, robust RMSEA = 0.035, 90% CI [0.0; 0.106], SRMR = .045. Constraining the correlations did not result in worse model fit, scaled χ^2 (47) = 44.533, p = .575, scaling factor = 0.993, robust CFI = 1.000, robust TLI = 1.007, robust RMSEA = 0.000, 90% CI [0.0; 0.072], SRMR = .064, $\Delta\chi^2$ = 20.839, Δdf = 25, p = .702. This result indicates that the correlations between the variables were similar for the isiXhosa and isiZulu groups. Constraining all the regressions to be equal resulted in worse model fit, scaled χ^2 (66) = 80.615, p = .106, scaling factor = 1.029, robust CFI = 0.981, robust TLI = 0.969, robust RMSEA = 0.057, 90% CI [0.0; 0.097], SRMR = .073, $\Delta\chi^2$ = 34.669, Δdf = 19, p = .015. I used the lavTestScore function to identify which parameters should be freed to improve model fit. This function indicated that the direct effects of L1 and English PA on English reading should be free to vary for each group. Thus, the effect of L1 PA and English PA on English reading differed between the groups. This model had good fit to the data and was not significantly different from the model where all regressions were freely estimated, scaled χ^2 (64) = 61.908, p = .551, scaling factor = 1.018, robust CFI = 1.0, robust TLI = 1.005, robust RMSEA = 0.0, 90% CI [0.0; 0.068], SRMR = .069, $\Delta\chi^2$ = 17.23, Δdf = 17, p = .435. The direct, indirect, and total effects on each outcome, as well as the proportion of variance explained in the outcomes, were calculated (*Table 4-9*).

The only significant predictors of LRF in grade 1 were L1 PA, English PA and RAN Digits. The coefficient for L1 PA and Ran Digits was similar (.34 and .35), and English PA was slightly lower (.21). LRF and English PA had positive direct effects on L1 and English reading. The effect of LRF was twice as large for L1 reading (.49) than English reading (.26), but the direct effect of English PA was consistent for L1 and English reading (approximately .26). English vocabulary had a small and negative effect (-.08) on L1 reading. The direct and indirect effects were summed to ascertain the total effect of each predictor variable on reading. Although RAN digits was a significant indirect predictor of reading, its total effect failed to reach significance (p = .060 for L1 reading, p = .190 for English reading). The total effect of L1 PA was significant (.25, p = .010) for L1 reading for both groups, and half the effect size of LRF. The groups differed in the effect size for L1 PA on English reading. L1 PA had a significant total effect (.32, p < .001) on English reading only for the isiZulu group. L1 PA made a very small and nonsignificant (.05, p = .564) total contribution to English reading. The total effect of English PA on English reading was slightly larger in the isiZulu (.32) than the isiXhosa group (.28). Overall, the model explained a large proportion of variance (above .50) in the mediator and outcome variables, although more variance was explained in the isiZulu group's data (Table *4-9*). For example, the model explained 48.3% and 65.5% of the variance in English reading for the isiXhosa and isiZulu groups respectively. The correlation between L1 and English reading was strong and slightly stronger in the isiZulu group (r = .79) than the isiXhosa group (r = .69).

Table 4-9. Results of path analysis predicting L1 and English reading fluency with LRF as a mediator in grade 1

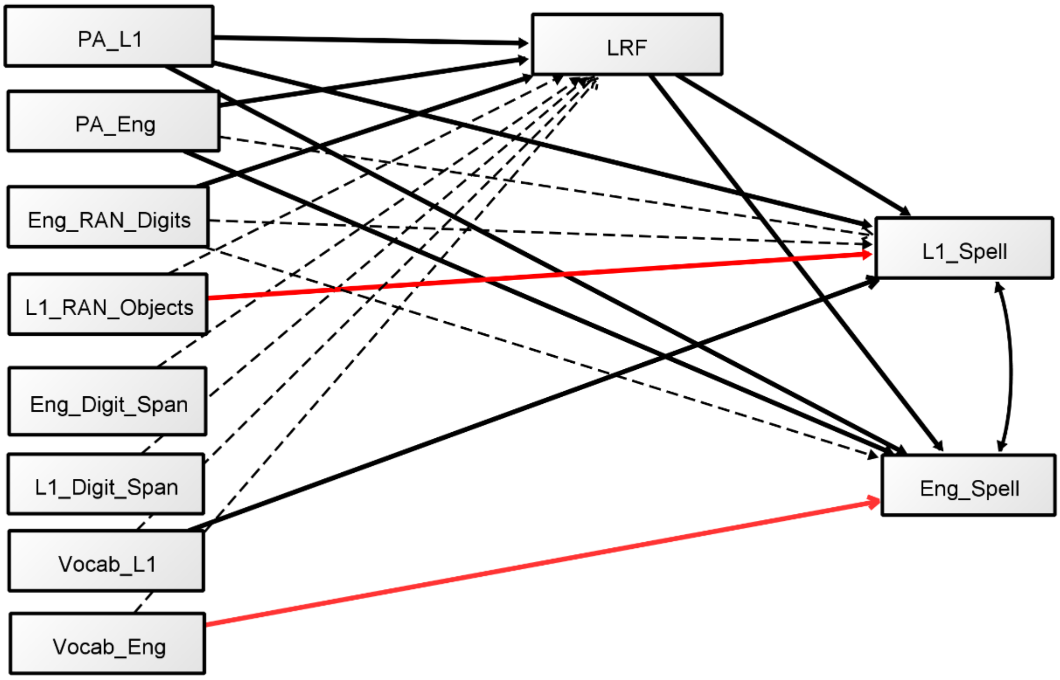
		LRF		**L1 Reading Fluency**				**English Reading Fluency**			
	Variables	**Tot.**	**p**	**Dir.**	**Ind.**	**Tot.**	**p**	**Dir.**	**Ind.**	**Tot.**	**p**
isiXhosa	LRF	.	.	**0.49**	.	**0.49**	**.000**	**0.26**	.	**0.26**	**.004**
	L1 PA	**0.35**	**.000**	0.08	**0.17**	**0.25**	**.010**	-0.04	**0.09**	0.05	.564
	Eng PA	**0.21**	**.009**	**0.26**	**0.10**	**0.36**	**.000**	**0.22**	**0.05**	**0.28**	**.001**
	Eng Ran Digits	**0.34**	**.000**	-0.06	**0.17**	0.10	.060	-0.03	**0.09**	0.06	.190
	L1 RAN Objects	0.01	.818	-0.08	0.00	-0.08	.097	-0.07	0.00	-0.07	.098
	Eng Digit Span	0.05	.341	.	0.02	0.02	.373	.	0.01	0.01	.41
	L1 Digit Span	0.01	.849	.	0.01	0.01	.849	.	0.00	0.00	.85
	L1 Vocab	-0.04	.512	.	0.00	0.00	.963	.	-0.01	-0.01	.52
	Eng Vocab	0.00	.963	**-0.08**	0.00	**-0.08**	.044	.	0.00	0.00	.96
	R^2	.593		.652				.483			
isiZulu	LRF	.		**0.49**	.	**0.49**	**.000**	**0.26**	.	**0.26**	**.004**
	L1 PA	**0.35**	**.000**	0.08	**0.17**	**0.25**	**.010**	0.14	**0.09**	**0.23**	**.002**
	Eng PA	**0.21**	**.009**	**0.26**	**0.10**	**0.36**	**.000**	**0.26**	**0.05**	**0.32**	**.000**
	Eng Ran Digits	**0.34**	**.000**	-0.06	**0.17**	0.10	.060	-0.03	**0.09**	0.06	.190
	L1 RAN Objects	0.01	.818	-0.08	0.00	-0.08	.097	-0.07	0.00	-0.07	.098
	Eng Digit Span	0.05	.341	.	0.02	0.02	.373	.	0.01	0.01	.410
	L1 Digit Span	0.01	.849	.	0.01	0.01	.849	.	0.00	0.00	.850
	L1 Vocab	-0.04	.512	.	0.00	0.00	.963	.	-0.01	-0.01	.520
	Eng Vocab	0.00	.963	**-0.08**	0.00	**-0.08**	.044	.	0.00	0.00	.960
	R^2	.721		.692				.656			

Notes: The correlation between L1 and English reading fluency is .69 (isiXhosa group) and .79 (isiZulu group). For explanation of how direct, indirect, and total effects are calculated see section 4.3.3.4.

4.3.4.2 Path analysis for spelling

A multigroup path model was fit to the data predicting L1 and English spelling, with letter-sound fluency as a mediator The model included direct paths from the exogenous (predictor) variables to LRF. Direct paths to L1 and English spelling were included for the two PA variables and the two RAN variables. Inspection of the residuals in the initial configural model revealed that a direct path from L1 vocabulary to L1 spelling, and English vocabulary to English spelling was needed and so these paths were inserted into the configural model. The final model per group is presented in *Figure 4-13*.

(a) isiXhosa



(b) isiZulu

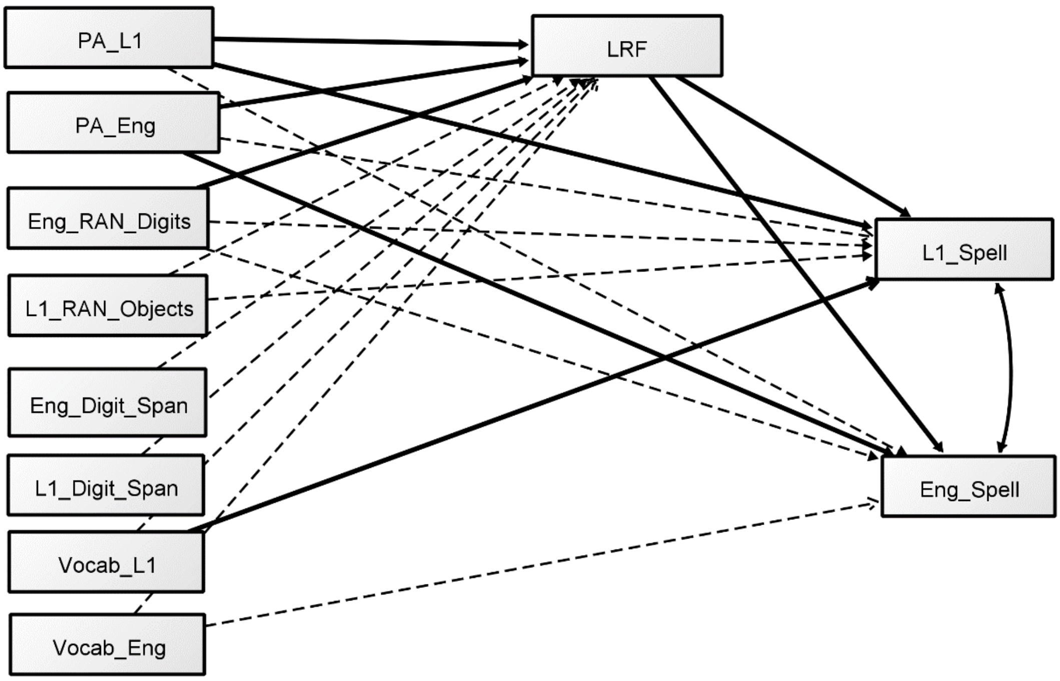


Figure 4-13. Path diagram of predictors of spelling in grade 1 for the (a) isiXhosa and (b) isiZulu groups

Notes: Solid paths represent significant positive regressions. Solid red paths represent significant negative regressions. Broken lines represent non-significant regressions.

The revised configural model fit the data well, scaled χ^2 (22) 20.000, p = .583, scaling factor = 0.987, robust CFI = 1.000, robust TLI = 1.015, robust RMSEA = 0.000, 90% CI [0.0; 0.089], SRMR = .048. This result indicates that the model fit the data for both language groups. Constraining the correlations did not result in worse model fit, scaled χ^2 (47) = 44.165, p = .591, scaling factor = 1.009, robust CFI = 1.000, robust TLI = 1.010, robust RMSEA = 0.000, 90% CI [0.0; 0.072], SRMR = .066, $\Delta\chi^2$ = 24.138, Δdf = 25, p = .511. Thus, the predictor variables were similarly associated with one another for each language group. Constraining the regressions to be equal resulted in worse model fit. The model was inspected and revealed that the path between English vocabulary and English spelling, and the path between L1 RAN objects and L1 spelling were not the same for the language groups. After these two paths were left to vary, the model had acceptable fit, scaled χ^2 (64) = 56.926, p = .723, scaling factor = 1.024, robust CFI = 1.000, robust TLI = 1.019, robust RMSEA = 0.000, 90% CI [0.0; 0.057], SRMR = .069, $\Delta\chi^2$ = 12.886, Δdf = 17, p = .7438. The direct, indirect, and total effects on each outcome, as well as the proportion of variance explained in the outcomes, were calculated (*Table 4-10*).

The significant predictors of LRF were the same as the model for reading fluency and include L1 PA, English PA, and English RAN Digits. The direct predictors of L1 spelling included LRF (.49), L1 PA (.24) and English vocabulary (.17). For the isiXhosa group only, the effect of L1 RAN objects on L1 spelling was negative (-.23); the effect was almost zero in the isiZulu group. In terms of total effects, LRF (.49) and L1 PA (.41) had a similar effect size, and English PA (.22), English RAN digits (.18) and L1 vocabulary (.17) had a similar effect size. The total effect of L1 RAN objects (-.22) was negative for the isiXhosa group.

For English spelling, LRF (.35) and English PA (.41) were significant positive predictors. English vocabulary (-.17) was a significant negative predictor of English spelling only for the isiXhosa group. With regards to total effects, English PA (.49), LRF (.35) and L1 PA (.24) were significant for both groups. English vocabulary remained a significant negative predictor of English spelling for the isiXhosa group. The estimated correlation between L1 and English spelling was low for both groups (.16 and .20). The model explained at least half the variance in the outcome variables. The variance explained was higher for the isiZulu group than the isiXhosa group for LRF and L1 spelling but was similar for English spelling.

Table 4-10. Results of path analysis predicting L1 and English spelling with LRF as a mediator in grade 1

		LRF		**L1 Spelling**				**English Spelling**			
	Variables	**Tot.**	**p**	**Dir.**	**Ind.**	**Tot.**	**P**	**Dir.**	**Ind.**	**Tot.**	**p**
Xhosa	LRF	.	.	**0.49**	.	**0.49**	**.00**	**0.35**		**0.35**	**.00**
	L1 PA	**0.35**	**.00**	**0.24**	**0.17**	**0.41**	**.00**	0.12	**0.12**	**0.24**	**.02**
	Eng PA	**0.21**	**.01**	0.11	**0.10**	**0.22**	**.05**	**0.41**	**0.07**	**0.49**	**.00**
	Eng Ran Digits	**0.34**	**.00**	0.01	**0.17**	**0.18**	.01	-0.12	**0.12**	0.00	1.00
	L1 RAN Objects	0.01	.82	**-0.23**	0.00	**-0.22**	.02	.	0.00	0.00	.82
	Eng Digit Span	0.05	.34	.	0.02	0.02	.35	.	0.02	0.02	.39
	L1 Digit Span	0.01	.85	.	0.01	0.01	.85	.	0.00	0.00	.85
	L1 Vocab	-0.04	.51	**0.17**	0.00	**0.17**	.01	.	-0.01	-0.01	.51
	Eng Vocab	0.00	.95	**.**	0.00	0.00	.95	**-0.17**	0.00	**-0.16**	**.04**
	R^2	.592		.547				.560			
Zulu	LRF	.	.	**0.49**	.	**0.49**	**.00**	**0.35**	.	**0.35**	**.00**
	L1 PA	**0.35**	.00	**0.24**	**0.17**	**0.41**	**.00**	0.12	**0.12**	**0.24**	**.02**
	Eng PA	**0.21**	.01	0.11	**0.10**	**0.22**	**.05**	**0.41**	**0.07**	**0.49**	**.00**
	Eng Ran Digits	**0.34**	.00	0.01	**0.17**	**0.18**	**.01**	-0.12	**0.12**	0.00	1.00
	L1 RAN Objects	0.01	.82	0.01	0.00	0.02	.82	.	0.00	0.00	.82
	Eng Digit Span	0.05	.34	.	0.02	0.02	.35	.	0.02	0.02	.39
	L1 Digit Span	0.01	.85	.	0.01	0.01	.85	.	0.00	0.00	.85
	L1 Vocab	-0.04	.51	**0.17**	0.00	**0.17**	.01	.	-0.01	-0.01	.51
	Eng Vocab	0.00	.95	**.**	0.00	0.00	.95	0.14	0.00	0.14	.13
	R^2	.721		.704				.526			

Notes: correlation between L1 and English spelling is .16 (isiXhosa group) and .20 (isiZulu group). For explanation of how direct, indirect, and total effects are calculated see section 4.3.3.4.

4.3.4.3 Summary: Path analysis

The path analysis models showed that LRF was predicted by L1 PA, English PA, and English RAN digits to the same extent in each language group. Reading fluency in both languages was directly predicted by LRF and English PA. The total effect of L1 PA was significant for L1 reading fluency (both groups), and for English reading fluency (isiZulu group only). The total effect of RAN digits on reading fluency was not significant, rather it had an indirect effect on reading fluency via LRF. English vocabulary was negatively related to L1 reading fluency. Spelling was directly predicted by LRF, and within-language PA. L1 spelling was also predicted by L1 vocabulary. For the isiXhosa group only, English vocabulary was negatively related to English spelling. The effect of RAN digits on spelling was again mediated via LRF, and the total effect of RAN digits was significant only for L1 spelling.

4.4 CONCLUSION

In this chapter, I presented the results of the cross-sectional analysis of grade 1 data. For the most part, the isiXhosa and isiZulu group had similar mean scores on the measures. The groups differed in their overall vocabulary levels: the isiXhosa group had a larger L1 vocabulary than the isiZulu group, and the isiZulu group had a larger English vocabulary than the isiXhosa group. Overall, however, both groups had larger L1 than English vocabularies. The groups also differed in NWR in both languages (the isiXhosa group had higher scores on both tasks), RAN objects in English (the isiZulu group was faster than the isiXhosa group) and RAN colours (the isiZulu group was faster than isiXhosa group). The sample included a large number of non-readers and non-writers with many children unable to read a word correctly or spell a word correctly at the end of grade 1. Even with the easier tasks (name writing and partial spelling scores) about 10-20% of the sample were non-readers/non-writers. The correlation analysis demonstrated that, for the most part, the relationships between variables were similar for the isiXhosa and isiZulu groups. MGCFA models revealed that PA was best conceptualised as two highly correlated language specific factors in grade 1. PWM, and RAN, were best conceptualised as language general factors. These models fit the data adequately for both the isiXhosa and isiZulu groups. The path analysis models revealed that LRF and PA were consistent predictors of L1 and English reading and spelling. English RAN digits was significantly directly related to LRF and its total effect was not always significant. PWM did not emerge as a significant predictor. The role of vocabulary was more interesting. L1 vocabulary was positively related to L1 spelling for both groups. English vocabulary was negatively related to L1 reading fluency for both groups, and to English spelling for the isiXhosa group only. L1 RAN Objects did not have a significant direct effect on reading or spelling. In the following chapter, I reproduce these analytic methods using cross-sectional data from the start of grade 3 (t2).

5 Chapter 5. The relationship between cognitive-linguistic skills and literacy skills at the start of grade 3

5.1 INTRODUCTION

In this chapter, I address the concurrent (cross-sectional) within- and between-language relationships between phonological processing skills and literacy at t2 (start of grade 3). There was a gap of six school terms between t1 (end of grade 1, 2019) and t2 (start of grade 3, 2021) data collection due to the COVID-19 pandemic related school closures in 2020. It is very likely that these school closures affected the development of both phonological processing and literacy skills. Thus, these results are presented as grade 3 results for this sample, who may be dissimilar to other grade 3 samples pre- or post-pandemic. This chapter begins with a summary of the method followed at t2. The results are then presented beginning with the descriptive statistics, correlations, confirmatory factor analyses of bilingual dimensionality, and ending with a presentation of the path analyses.

5.2 METHOD

For ease of reference, this section briefly summarises information about the participants, research instruments and procedures which were used at t2, as presented in chapter 3.

5.2.1 Participants

The t2 grade 3 sample included 122 participants (55% girls). 62 children (36 girls) were from the isiXhosa school, and 60 children (31 girls) were from the isiZulu schools. A Welch's t-test indicated that the isiXhosa (M = 8.5, SD = 0.5) and isiZulu (M = 8.4, SD = 0.4) groups did not differ significantly in their age at t2, t(109.88) = 0.93, p = .356, d = .17. The rate of attrition between t1 and t2 was 13%. The participants who remained in the sample and those who attrited were not markedly different from one another in their grade 1 scores[28], suggesting that the remaining sample was likely not biased. Of those who remained in the sample, a large proportion of children (18% in total) were not promoted to grade 3 in 2021 and were, therefore, repeating grade 2. Repeaters accounted for 24% (15 children) in the isiXhosa group and 17% (10 children) in the isiZulu group. The grade 1 scores were examined for the repeaters and progressed children who remained in the t2 sample. Cohen's d analysis on the repeaters' grade 1 scores indicated that the group of repeaters had lower scores on all variables compared to the participants in grade 3 in 2021, representing a medium to large effect. Nevertheless, the proportion of attrition and grade repetition is similar to what was reported for the EGRS 1 (Taylor et al., 2017). Thus, the pandemic-related school closures seem not to have biased who was available for t2 testing.

[28] The grade 1 scores of the participants who remained in the sample and those who dropped out of the sample were compared using Cohen's d effect size. For all comparisons, the effect size overlapped with zero and corresponded to a small point estimate.

5.2.2 Instruments

Participants completed a battery of phonological processing and literacy tests at t2, discussed in detail in chapter 3, and included in appendix A3.2 in section 9.3.2. The same constructs were assessed as at t1. The phonological processing, LRF, L1 and English word reading, and English text reading tasks were exactly the same. The L1 texts were updated to be grade appropriate, the name writing task was removed as it was deemed too easy for grade 3, and an additional spelling word was included for each language.

5.2.3 Data collection procedure

Participants were assessed towards the end of term 1 of 2021 (t2). The battery of tests was completed individually over two sessions in an L1 session and an English session.

5.2.4 Data analysis procedure

Data analysis was undertaken in four phases which included descriptive statistics, correlation analysis, confirmatory factor analysis of the phonological processing tasks per construct, and path analysis. These phases are described in more detail in chapter 3 section 3.8.3.1.

5.3 RESULTS

The results section is organised into four sections, as per the data analysis procedures section. I present the descriptive statistics first, followed by the correlational analysis. Third, I fit confirmatory factor analysis models to the data to establish the bilingual dimensionality of phonological processing. Finally, path models were fit to the data predicting reading and spelling.

5.3.1 Descriptive statistics

Table 5-1 includes the sample size, median, mean, standard deviation, minimum and maximum scores and the proportion of participants scoring zero. These statistics are presented per task and per language group. The median and proportion of children scoring zero are included the data was still not normally distributed for most tasks. Effect sizes and their confidence intervals are presented in the table, rather than p values as suggested by Larson-Hall and Plonsky (2015). I interpreted the effect sizes using the guidelines of Plonsky and Oswald (2014) who suggested revised benchmarks of d = .40 (small), d = .70 (medium), and d = 1.0 (large) based on observed effect sizes in Applied Linguistics research. The confidence intervals of the effect sizes which do not overlap with zero are indicated in bold in *Table 5-1*. For almost all the between-groups comparisons, the isiXhosa and isiZulu groups did not differ in the mean scores, since the effect sizes overlapped with zero. Scores were better for the isiZulu group for L1 NWR, English digit span, English RAN colours, English RAN Objects and English sight word reading fluency. Scores were higher for the isiXhosa group for letter recognition accuracy and fluency, L1 word reading accuracy and fluency, L1 spelling. For these tasks which had effect size confidence intervals which did not overlap with zero, I ran t-tests using the Benjamini and Hochberg (also known as FDR) correction method to control for Type 1 errors. These results are presented in the text. I also report the within-subjects' effects for tasks which had a similar metric for the L1 and English versions. For example, RAN was measured in number of seconds, and word reading was measured in number of words read correctly. In terms of within group effects, I also used the suggested revised benchmarks of Plonsky and Oswald (2014) of d = .60 (small), d = 1.0 (medium), and d = 1.4 (large) for within-subject effects in Applied Linguistics research.

Table 5-2 presents the descriptive statistics for the combined sample. This table is included only to provide access to the combined sample, for future researchers who might want to conduct a meta-analysis (e.g., if their interest is solely on English L2) (Larson-Hall & Plonsky, 2015). The results in *Table 5-2* are, thus, not interpreted. In the following sub-sections I summarise the information of interest per task and include figures to visualise the data where appropriate.

Table 5-1. Distribution of scores by language at the start of grade 3 (t2) including Cohen's d effect size

	isiXhosa							isiZulu							Effect size	
Task (unit/maximum score)	**n**	**Mdn**	**M**	**SD**	**Min**	**Max**	**% zero**	**n**	**Mdn**	**M**	**SD**	**Min**	**Max**	**% zero**	**d**	**95% CI**
First Language (L1)																
PA: Blending (/10)	62	6.0	5.6	2.6	0	10	2	60	4.0	4.6	2.8	0	10	10	0.4	[0.0, 0.8]
PA: Elision (/10)	62	2.5	3.4	2.7	0	9	10	60	2.5	3.0	2.9	0	10	28	0.2	[-0.2, 0.5]
PA: Isolation (/5)	62	3.0	2.7	1.4	0	5	8	60	3.0	2.6	1.7	0	5	15	0.1	[-0.3, 0.4]
PWM: Digit Span (/15)	62	6.0	6.3	2.1	3	15	0	60	5.0	5.5	3.0	0	14	2	0.3	[-0.1, 0.7]
PWM: Nonword Repetition (/18)	62	6.0	6.1	3.0	0	13	3	60	7.5	7.5	3.5	0	13	5	**-0.4**	**[-0.8, -0.1]**
RAN: Letters (s)	61	34.4	42.2	21.7	16	107	0	55	40.4	47.4	26.9	18	141	0	-0.2	[-0.6, 0.2]
RAN: Objects (s)	62	49.3	50.4	14.2	31	108	0	60	49.3	52.7	18.1	20	134	0	-0.1	[-0.5, 0.2]
Literacy: LR Accuracy (prop.)	62	1.0	0.9	0.2	0	1	2	60	0.8	0.7	0.2	0	1	2	**0.5**	**[0.1, 0.9]**
Literacy: LRF (clpm)	62	41.5	38.1	20.7	0	80	2	60	24.0	28.5	19.5	0	67	2	**0.5**	**[0.1, 0.8]**
Literacy: RWR (cw)	62	17.0	12.0	8.3	0	20	21	60	3.5	8.3	8.4	0	20	35	**0.4**	**[0.1, 0.8]**
Literacy: RWR Accuracy (prop.)	62	0.8	0.6	0.4	0	1	21	60	0.2	0.4	0.4	0	1	35	**0.4**	**[0.1, 0.8]**
Literacy: RWR Fluency (cwpm)	62	8.9	13.9	15.6	0	68	21	60	2.4	10.9	14.4	0	63	35	0.2	[-0.2, 0.6]
Literacy: TR Accuracy (prop.)	62	0.8	0.5	0.5	0	1	40	60	0.1	0.4	0.4	0	1	50	0.3	[-0.1, 0.6]
Literacy: TR Fluency (cwpm)	62	8.0	9.9	11.6	0	49	40	60	0.5	7.4	10.4	0	42	50	0.2	[-0.1, 0.6]
Literacy: Can spell 'imoto'	62	1.0	0.7	0.5	0	1	34	60	0.0	0.4	0.5	0	1	62	**0.6**	**[0.2, 0.9]**
Literacy: Spelling total 'imoto' (/6)	62	6.0	4.7	2.0	0	6	5	60	4.0	3.7	2.2	0	6	13	**0.5**	**[0.1, 0.8]**
Literacy: Can spell 'indlebe'	62	0.0	0.3	0.5	0	1	68	60	0.0	0.2	0.4	0	1	82	0.3	[0.0, 0.7]
Literacy: Spelling total 'indlebe' (/8)	62	5.0	4.6	2.9	0	8	3	60	2.0	3.3	2.9	0	8	12	**0.4**	**[0.1, 0.8]**
English																
PA: Blending (/33)	61	3.0	5.5	6.6	0	33	28	60	3.0	5.2	5.3	0	19	12	0.0	[-0.3, 0.4]
PA: Elision (/34)	61	5.0	7.1	6.0	0	22	13	60	5.0	6.8	7.1	0	28	23	0.0	[-0.3, 0.4]
PA: Isolation (/32)	61	12.0	11.2	6.0	0	27	2	59	10.0	11.3	7.5	0	28	10	0.0	[-0.4, 0.3]
PWM: Digit Span (/28)	62	14.0	14.5	2.7	9	21	0	60	16.0	16.2	4.3	9	26	0	**-0.5**	**[-0.9, -0.1]**
PWM: Nonword Repetition (/30)	62	19.0	18.8	4.6	9	28	0	60	18.0	17.8	3.0	6	23	0	0.3	[-0.1, 0.6]

Task (unit/maximum score)	isiXhosa							isiZulu							Effect size	
	n	Mdn	M	SD	Min	Max	% zero	n	Mdn	M	SD	Min	Max	% zero	d	95% CI
RAN: Colours (s)	61	49.4	56.8	21.1	28	125	0	59	42.7	45.4	13.5	26	94	0	**0.6**	**[0.3, 1.0]**
RAN: Digits (s)	62	30.4	34.3	14.0	19	95	0	59	28.4	32.5	12.1	20	85	0	0.1	[-0.2, 0.5]
RAN: Objects (s)	62	60.1	69.6	32.7	31	220	0	60	51.9	53.8	17.7	29	124	0	**0.6**	**[0.2, 1.0]**
Literacy: NWR (cw)	62	3.0	4.1	5.0	0	24	29	60	2.0	5.2	7.6	0	30	42	-0.2	[-0.5, 0.2]
Literacy: NWR Accuracy (prop.)	62	0.2	0.2	0.2	0	1	29	60	0.2	0.2	0.3	0	1	42	0.0	[-0.3, 0.4]
Literacy: NWR Fluency (cwpm)	62	2.0	3.0	3.9	0	25	29	60	2.7	3.6	4.7	0	25	42	-0.1	[-0.5, 0.2]
Literacy: RWR (cw)	62	1.0	4.1	6.1	0	25	48	60	1.0	5.2	8.1	0	30	45	-0.2	[-0.5, 0.2]
Literacy: RWR Accuracy (prop.)	62	0.1	0.2	0.2	0	1	48	60	0.2	0.2	0.3	0	1	45	-0.2	[-0.5, 0.2]
Literacy: RWR Fluency (cwpm)	62	0.7	2.7	4.5	0	26	48	60	1.6	4.5	7.2	0	37	45	-0.3	[-0.7, 0.1]
Literacy: SWR (cw)	62	0.0	2.4	4.9	0	20	53	60	0.5	4.6	7.3	0	29	50	-0.3	[-0.7, 0.0]
Literacy: SWR Accuracy (prop.)	62	0.0	0.1	0.2	0	1	53	60	0.1	0.2	0.3	0	1	50	-0.4	[-0.7, 0.0]
Literacy: SWR Fluency (cwpm)	62	0.0	2.1	3.8	0	21	53	60	0.9	4.8	7.5	0	41	50	**-0.5**	**[-0.8, -0.1]**
Literacy: TR Accuracy (prop.)	62	0.6	0.5	0.4	0	1	26	60	0.5	0.5	0.3	0	1	15	-0.1	[-0.4, 0.3]
Literacy: TR Fluency (cwpm)	62	7.0	14.1	19.3	0	100	26	60	6.5	18.0	22.5	0	110	15	-0.2	[-0.5, 0.2]
Literacy: Can spell 'dog'	62	0.0	0.4	0.5	0	1	61	60	0.0	0.3	0.5	0	1	67	0.1	[-0.2, 0.5]
Literacy: Spelling total 'dog' (/4)	62	2.0	2.2	1.6	0	4	27	60	2.0	1.9	1.7	0	4	35	0.2	[-0.2, 0.6]
Literacy: Can spell 'sheep'	62	0.0	0.0	0.2	0	1	95	60	0.0	0.1	0.3	0	1	93	-0.1	[-0.4, 0.3]
Literacy: Spelling total 'sheep' (/6)	62	2.0	1.6	1.5	0	6	36	60	0.5	1.6	2.0	0	6	50	0.0	[-0.3, 0.4]

Notes: Positive effect sizes indicate a higher mean for the isiXhosa group. Large values for RAN indicate slower naming. Effect sizes which do not overlap with 0 are indicated in bold. s – seconds; LR – Letter recognition; prop. – proportion (percentage divided by 100); clpm – correct letters per minute; RWR – Regular word reading; cw – correct words; cwpm – correct words per minute; TR – Text reading; NWR – Nonword reading; SWR – Sight word reading.

Table 5-2. Distribution of scores at the start of grade 3 (t2) for the entire sample

Task (unit/maximum score)	N	Mdn	M	SD	Min	Max	% zero
First Language (L1)							
PA: Blending (/10)	122	5.0	5.1	2.7	0.0	10.0	5.7
PA: Elision (/10)	122	2.5	3.2	2.8	0.0	10.0	18.9
PA: Isolation (/5)	122	3.0	2.6	1.5	0.0	5.0	11.5
PWM: Digit Span (/15)	122	6.0	5.9	2.6	0.0	15.0	0.8
PWM: Nonword Repetition (/18)	122	7.0	6.8	3.3	0.0	13.0	4.1
RAN: Letters (s)	116	36.5	44.6	24.4	16.0	140.7	0.0
RAN: Objects (s)	122	49.3	51.5	16.2	20.0	133.7	0.0
Literacy: Letter Reading Accuracy	122	0.9	0.8	0.3	0.0	1.0	1.6
Literacy: LRF (clpm)	122	33.5	33.4	20.6	0.0	80.0	1.6
Literacy: Regular Word Reading (cw)	122	14.0	10.2	8.5	0.0	20.0	27.9
Literacy: Regular Word Reading Accuracy	122	0.7	0.5	0.4	0.0	1.0	27.9
Literacy: Regular Word Reading (cwpm)	122	6.6	12.4	15.0	0.0	68.2	27.9
Literacy: Text Reading Accuracy	122	0.3	0.5	0.5	0.0	1.0	45.1
Literacy: Text Reading (cwpm)	122	3.0	8.7	11.0	0.0	49.0	45.1
Literacy: Can spell 'imoto'	122	1.0	0.5	0.5	0.0	1.0	47.5
Literacy: Spelling total 'imoto' (/6)	122	6.0	4.2	2.2	0.0	6.0	9.0
Literacy: Can spell 'indlebe'	122	0.0	0.3	0.4	0.0	1.0	74.6
Literacy: Spelling total 'indlebe' (/8)	122	4.0	4.0	3.0	0.0	8.0	7.4
English							
PA: Blending (/33)	121	3.0	5.4	6.0	0.0	33.0	19.8
PA: Elision (/34)	121	5.0	7.0	6.5	0.0	28.0	18.2
PA: Isolation (/32)	120	11.0	11.3	6.7	0.0	28.0	5.8
PWM: Digit Span (/28)	122	15.0	15.3	3.7	9.0	26.0	0.0
PWM: Nonword Repetition (/30)	122	18.0	18.3	3.9	6.0	28.0	0.0
RAN: Colours (seconds)	120	45.6	51.2	18.6	26.4	125.3	0.0
RAN: Digits (seconds)	121	29.5	33.4	13.1	19.1	95.0	0.0

Task (unit/maximum score)	N	Mdn	M	SD	Min	Max	% zero
RAN: Objects (seconds)	122	55.0	61.8	27.5	29.0	220.0	0.0
Literacy: Nonword Reading (cw)	122	2.0	4.6	6.4	0.0	30.0	35.2
Literacy: Nonword Reading Accuracy	122	0.2	0.2	0.2	0.0	1.0	35.2
Literacy: Nonword Reading (cwpm)	122	2.1	3.3	4.3	0.0	25.0	35.2
Literacy: Regular Word Reading (cw)	122	1.0	4.6	7.1	0.0	30.0	46.7
Literacy: Regular Word Reading Accuracy	122	0.1	0.2	0.3	0.0	1.0	46.7
Literacy: Regular Word Reading (cwpm)	122	1.0	3.6	6.0	0.0	36.7	46.7
Literacy: Sight Word Reading (cw)	122	0.0	3.5	6.2	0.0	29.0	51.6
Literacy: Sight Word Reading Accuracy	122	0.0	0.2	0.2	0.0	1.0	51.6
Literacy: Sight Word Reading (cwpm)	122	0.0	3.4	6.0	0.0	40.9	51.6
Literacy: Text Reading Accuracy	122	0.6	0.5	0.4	0.0	1.0	20.5
Literacy: Text Reading (cwpm)	122	7.0	16.0	20.9	0.0	110.1	20.5
Literacy: Can spell 'dog'	122	0.0	0.4	0.5	0.0	1.0	63.9
Literacy: Spelling total 'dog' (/4)	122	2.0	2.1	1.7	0.0	4.0	31.1
Literacy: Can spell 'sheep'	122	0.0	0.1	0.2	0.0	1.0	94.3
Literacy: Spelling total 'sheep' (/6)	122	1.0	1.6	1.8	0.0	6.0	42.6

Notes: s – seconds; LR – Letter recognition; prop. – proportion (percentage divided by 100); clpm – correct letter per minute; RWR – Regular word reading; cw – correct words; cwpm – correct words per minute; TR – Text reading; NWR – Nonword reading; SWR – Sight word reading.

5.3.1.1 PA

There were small effect size differences between the groups on the PA tasks which overlapped with zero (*Table 5-1*). On average, for the tasks administered in L1, the isiXhosa group scored 6 (SD = 3), 3 (SD = 3) and 3 (SD = 1), and the isiZulu group scored 5 (SD = 3), 3 (SD = 3) and 3 (SD = 2), on the blending, elision, and isolation tasks respectively. On average, for the tasks administered in English, the isiXhosa group scored 6 (SD = 7), 7 (SD = 6) and 11 (SD = 6), and the isiZulu group scored 5 (SD = 5), 7 (SD = 7) and 11 (SD = 8), on the blending, elision, and isolation tasks respectively.

Figure 5-1 shows the distribution of PA scores in percentages per test language. The same data split by language group is presented in *Figure 5-2*. The figures show that L1 performance differed slightly between the isiXhosa and isiZulu groups. The isiXhosa group had more children with high scores in the L1 blending task than the isiZulu children. Elision was the most difficult task. In English, the children performed similarly on the elision and isolation tasks, but more isiZulu children had lower scores for English blending. English blending and elision were similarly difficult with scores clustered around zero, while the isolation task displayed a more normal distribution. Group differences will be further explored in the confirmatory factor analysis, which accounts for measurement error.

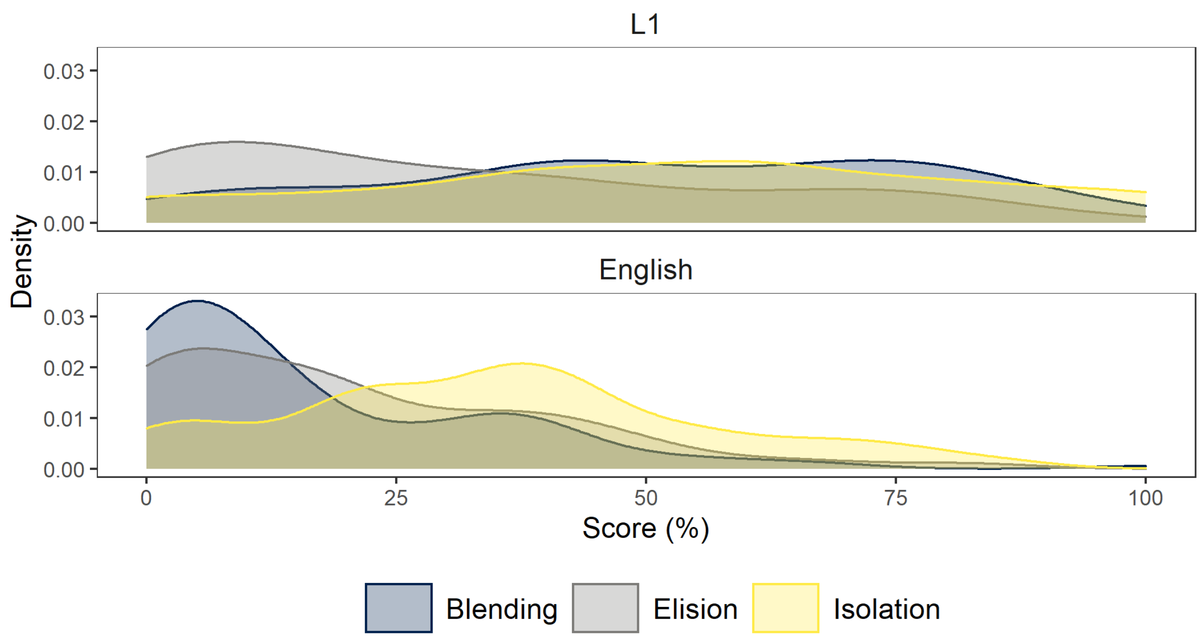


Figure 5-1. Density plots for total PA scores in L1 (top) and English (bottom) at the start of grade 3 for the whole sample

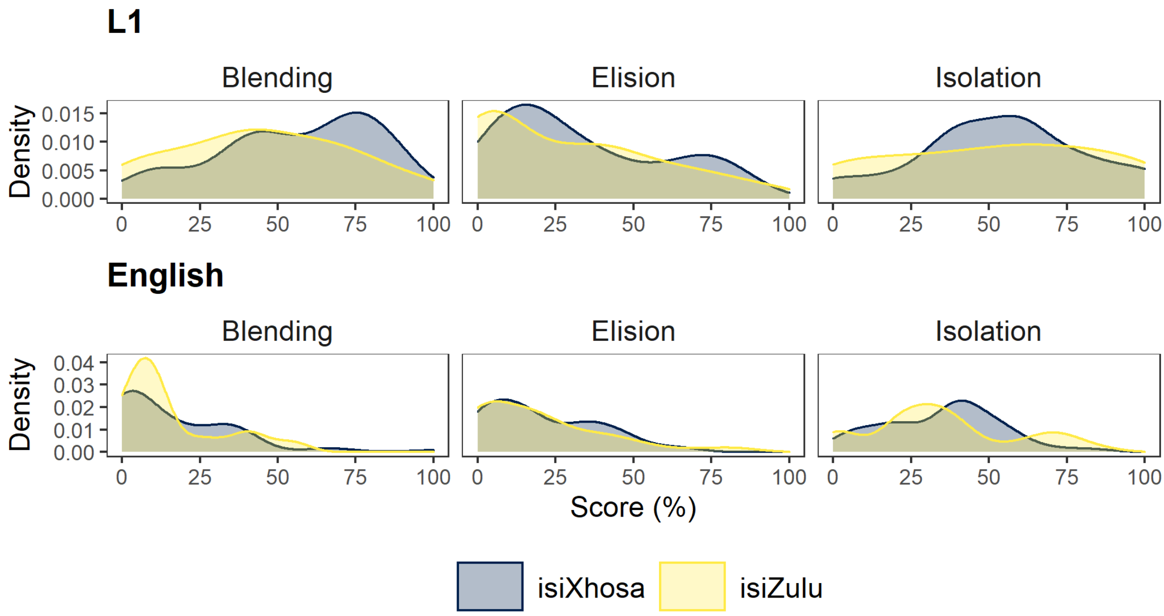


Figure 5-2. Density plots for total PA scores in L1 (top) and English (bottom) per language group at the start of grade 3

5.3.1.2 PWM

Figure 5-3 presents the distribution of scores in percentages for the PWM tasks. The language groups differed by small effect sizes in favour of the isiXhosa group for L1 digit span (d = 0.3) and English NWR (d = 0.3), but the confidence intervals overlapped zero. The language groups differed by small effect sizes in favour of the isiZulu group for L1 NWR (d = -0.4, t(117.0) = -2.3, p = .024, q = .024) and English digit span (d = -0.5, t(98.7) = -2.8, p = .007, q = .017) and the confidence intervals of the effect size did not overlap zero.

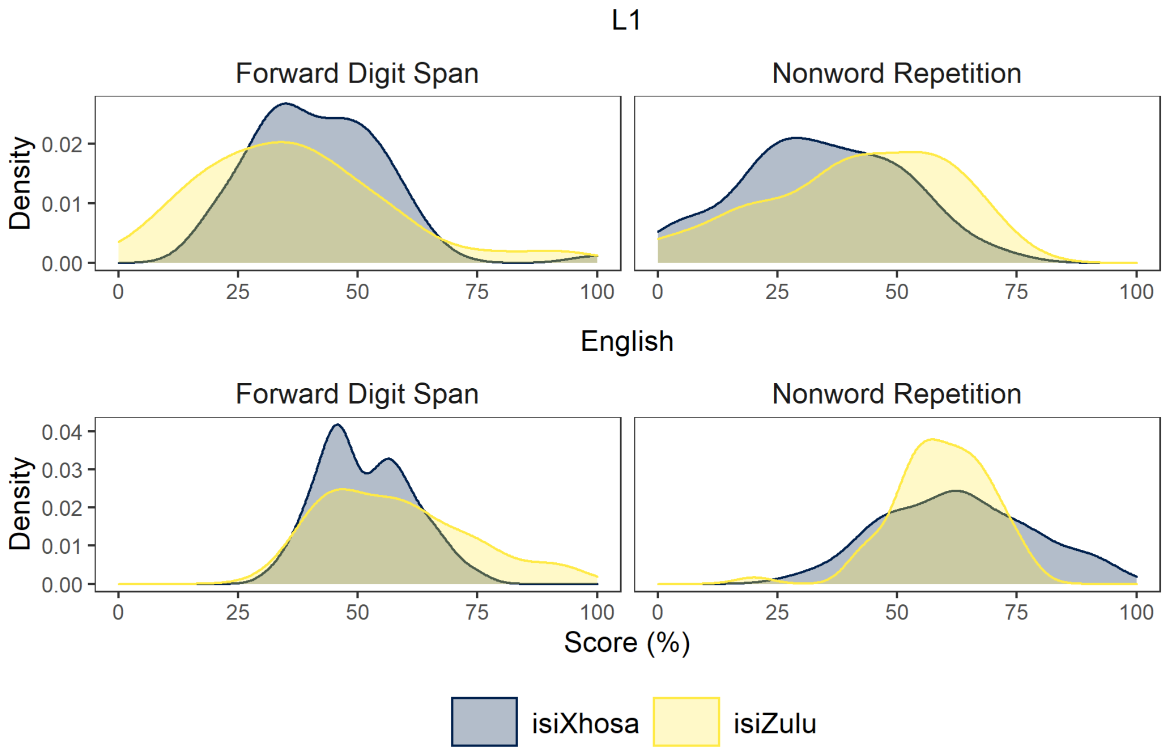


Figure 5-3. Density plots for digit span and NWR tasks in L1 (top) and English (bottom) per language group at the start of grade 3

5.3.1.3 RAN

Figure 5-4 plots density curves for the RAN tasks per language group and language of administration. *Table 5-1* shows that the groups did not differ in the total time taken to name letters (isiXhosa M = 42, SD = 22; isiZulu M = 47, SD = 27; d = -0.2, 95%CI [-0.6; 0.2]) or objects (isiXhosa M = 50, SD = 14; isiZulu M = 53, SD = 18; d = -0.1, 95%CI [-0.5; 0.2] in L1 (*Table 5-1*). However, more isiXhosa (n = 61) than isiZulu (n = 55) participants completed the letter naming task. The letter naming task was not administered if participants could not identify five of the six practice letters. There was also no between-groups difference for digit naming in English (isiXhosa M = 34, SD = 14; isiZulu M = 33, SD = 12; d = 0.1, 95%CI [-0.2; 0.5]). The isiZulu group named objects (isiXhosa M = 70, SD = 33; isiZulu M = 54, SD = 18; d = 0.6, 95%CI [0.2; 1.0], t(94.7) = 3.33, p = .001, q = .006) and colours (isiXhosa M = 57, SD = 21; isiZulu M = 45, SD = 14; d = 0.6, 95%CI [0.3; 1.0], t(102.5) = 3.54, p < .001 , q = .006) faster in English than the isiXhosa group. This represented a medium effect size for both tasks although the wide confidence interval indicates the effect could be from small to large.

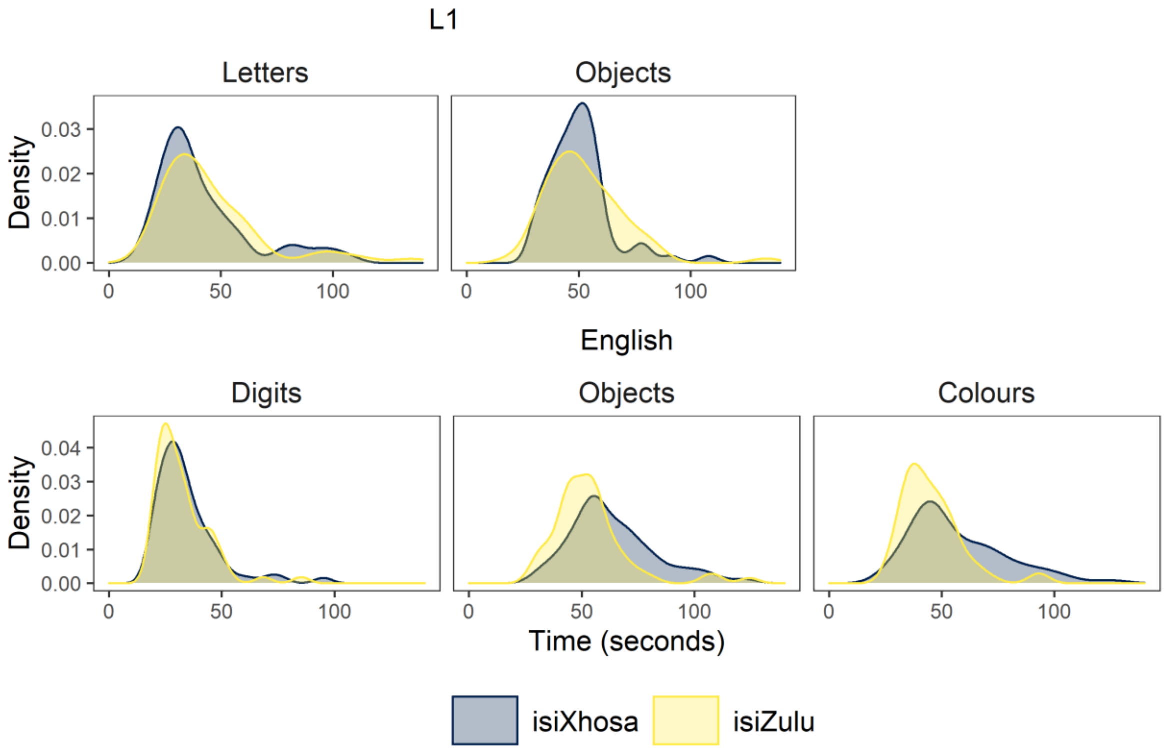


Figure 5-4. Density plots for RAN tasks in L1 (top) and English (bottom) per language group at the start of grade 3

The effect size of within-subjects differences in naming speed per task type was calculated (*Table 5-3*). Differences in naming speed were observed as per the literature. Alphanumeric tasks were faster than non-alphanumeric tasks (with the exception of L1 letters and L1 objects for the isiZulu group). Children were not yet automatically recognising letters as there was a small (to medium) effect size difference in favour of English digits which were recalled much faster. Children were also faster at naming English colours than English objects, possibly because colour names are typically only taught in English in South African classrooms where an African language is used as LoLT, and therefore may approximate L1 naming times.

Table 5-3. Within-subjects effect sizes (Cohen's d) with 95% confidence interval for RAN comparing language of administration and task types per language group in grade 3

Variables Compared		isiXhosa d [95% CI]	isiXhosa Effect	isiZulu d [95% CI]	isiZulu Effect	Description
L1 letters	L1 objects	-0.4 [-0.8; -0.1]	**small**	-0.2 [-0.6; 0.1]	none	L1 Letters faster than L1 objects for isiXhosa only.
L1 letters	Eng digits	-0.4 [-0.8; -0.1]	**small**	-0.7 [-1.1; -0.3]	**small-to-medium**	Eng digits faster than L1 letters.
L1 Letters	Eng objects	-1.0 [-1.4, -.6]	**large**	-0.3 [-0.7, 0.1	none	Letters faster than Eng objects for isiXhosa group only.
L1 letters	Eng colours	0.7 [0.3, 1.1]	**small-to-medium**	-1.0 [-0.5, 0.3]	none	Letters faster than Eng colours for isiXhosa group only.
L1 objects	Eng objects	0.8 [0.4; 1.1]	**small-to-medium**	0.1 [-0.3; 0.4]	none	Objects faster in L1 than English for isiXhosa group only.
Eng digits	Eng objects	-1.4 [-1.8; -1.0]	**large**	-1.4 [-1.8; -1.0]	**large**	Digits faster than objects in English.
Eng digits	Eng colours	1.3 [0.9; 1.6]	**large**	1.0 [0.6; 1.4]	**medium**	Digits faster than colours in English.
Eng objects	Eng colours	-0.5 [-0.8; -0.1]	**small**	-0.5 [-0.9; 0.2]	**small**	Colours faster than objects in English.

Notes: Within-group effect size interpretations used from Plonsky and Oswald (2014).

5.3.1.4 *Reading*

The distribution of the scores for the reading variables is presented in *Figure 5-5*. *Table 5-1* shows that there were small effect size differences between the isiXhosa and isiZulu groups in favour of the isiXhosa group for L1 letter reading accuracy (d = .5, 95%CI [.1; .9], t(119.4) = 2.76, p = .007, q = .017) and LRF (d = .4, 95%CI [.1; .8], t(119.9) = 2.63, p = .010, q = .019), and for L1 word reading accuracy (d = .4, 95%CI [.1; .8], t(119.7) = 2.41, p = .017, q = .022). There was a small effect size in favour of the isiZulu group for English sight word reading fluency (d = -.5, 95%CI [-.8; -.1], t(86.53) = -2.47, p = .016, q = .022). For all other literacy tasks, the effect size confidence intervals overlapped with zero.

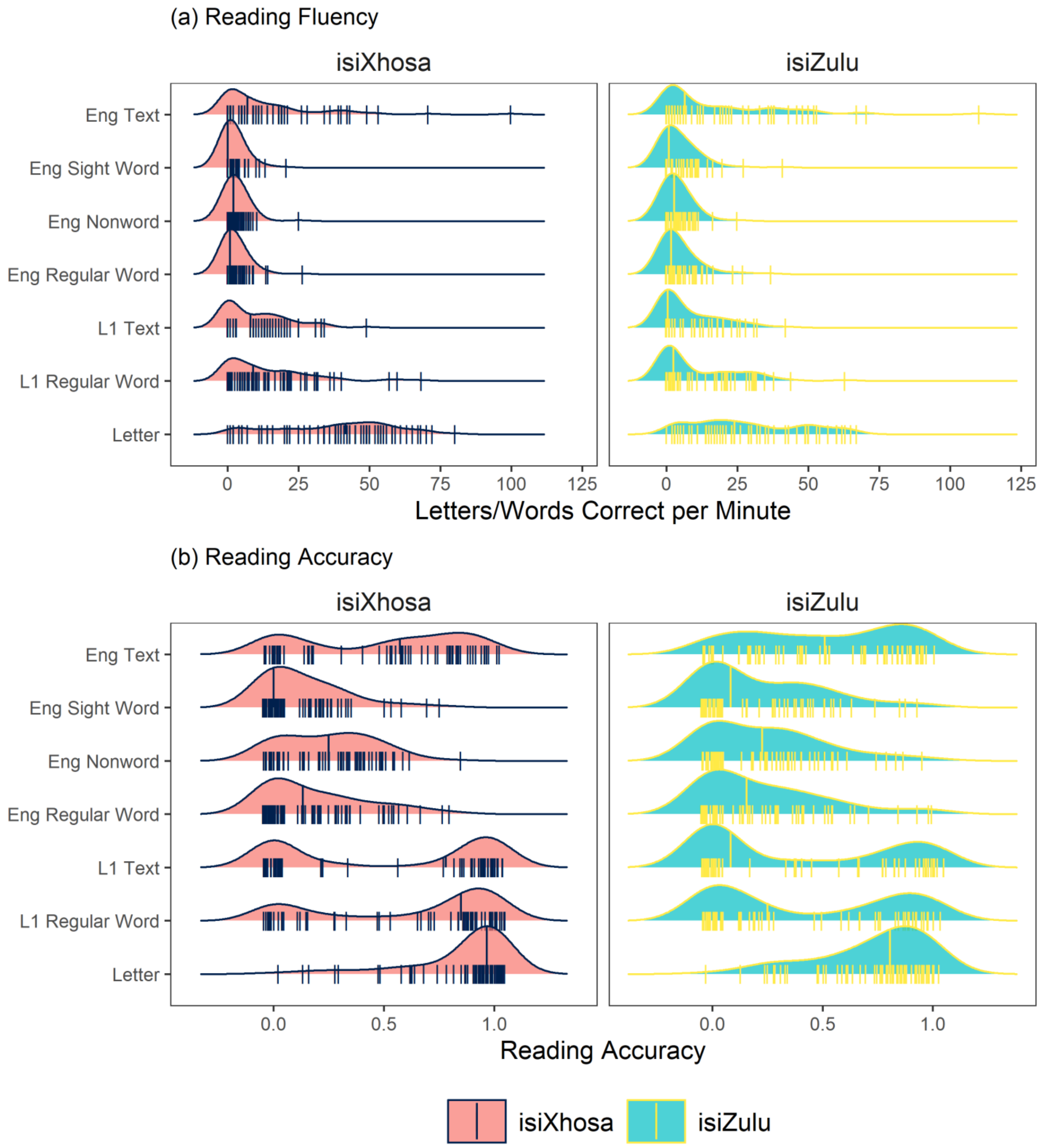


Figure 5-5. Distribution of reading fluency and reading accuracy for each indicator variable, language group and task language at the start of grade 3

Notes: the y axis of figure b is a proportion, which is a percentage divided by 100

The mean letters correct per minute for the LRF task was 16 (SD = 13) and 13 (SD = 12) for the isiXhosa and isiZulu groups respectively (*Figure 5-5*(a)). Six percent of the isiXhosa group and 10% of the isiZulu group scored zero. The word reading tasks were untimed, so the scores represent how many words were read correctly before the stop criterion of five consecutive errors was applied. The isiXhosa and isiZulu groups had the same means and standard deviations for all four reading tasks: L1 regular word reading (M = 4, SD = 7), English regular word reading (M = 1, SD = 3), English sight word reading (M = 1, SD = 2) and English nonword reading (M = 2, SD = 4) (*Table 5-1*). The large standard deviations and the clustering of points near zero in *Figure 5-5*(c) indicate floor effects. Indeed, more than half the participants scored zero for L1 regular word reading, and more than 70% of participants scored zero for the English word reading tasks (the exception was the isiXhosa group for English nonword reading where 57% received zero). Thus, the groups still include a large proportion of non-readers compared to t1.

With regard to text reading fluency, the groups performed similarly with a mean of 2 (isiXhosa SD = 4; isiZulu SD = 5) words read correctly in a minute on the L1 oral reading fluency task. The isiZulu group had a higher standard deviation since the maximum score is 27 compared to 18 in the isiXhosa group. More than 60% of participants could not read one word correctly. About the same number of participants could not read in English for the isiXhosa group, but in isiZulu just over 50% of participants could not read an English word. The isiZulu group (M = 4, SD = 10) read one more word on average in the English oral reading fluency task than the isiXhosa group (M = 3, SD = 7). The word reading fluency scores for L1, and English should not be directly compared because of the differences in word length in each language.

5.3.1.5 Spelling

The spelling task was scored in two ways. Firstly, dummy scoring was used to indicate whether the word was spelled completely correctly or not. In terms of absolute scoring, the isiXhosa group outperformed the isiZulu group in L1. *Table 5-1* shows that 66% of the isiXhosa group and 38% of the isiZulu group were able to spell *imoto* (*car*), with fewer children being able to spell *indlebe* (*ear*) which included the trigraph *ndl* (32% isiXhosa; 18% isiZulu). More children scored zero on the English spelling task. Less than 40% could spell *dog* correctly, and approximately 5% could spell *sheep* correctly. These low English scores are attributable to L1 interference. Many children spelled *dog* as *dogi* and *sheep* as *ship* which reflects their understanding of L1 phonology and spelling.

The spelling tasks were also scored in a second way to capture more variation in scores. In the partial scoring method, participants were awarded scores for each series of letters they wrote down correctly. For example, *imoto* spelled as *imto* was awarded a score of 4 out of 6 for the correct ordering of *_i*, *im*, *to*, and *o_*. The partial scoring accounted for participants in different phases of spelling development. The distribution of the spelling scores using partial scoring is presented as box plots in *Figure 5-6*. The isiXhosa group had higher partial spelling scores than the isiZulu group in L1 for *imoto* (d = .5, 95%CI [.1; .8], t(118.17) = 2.55, p = .012, q = .020) and *indlebe* (d = .4, 95%CI [.1; .8], t(119.88) = 2.32, p = .022, q = .024) with small effect sizes as the point estimate. English partial spelling scores were also low for both groups with approximately 30% of the sample scoring zero for *dog* and up to half scoring zero for *sheep* in the isiZulu group (compared to 36% for the isiXhosa group).

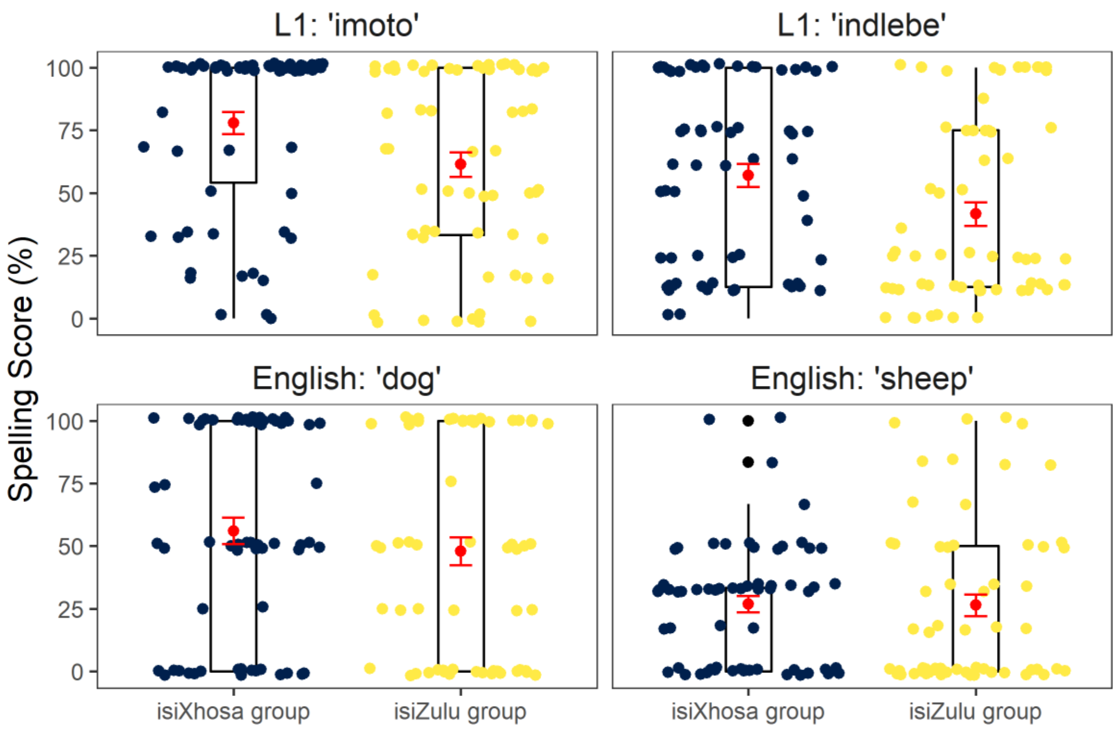


Figure 5-6. Boxplots with individual data points indicating the distribution of scores for the spelling tasks in L1 (top) and English (bottom) per language group with the mean and standard error (red) at the start of grade 3

5.3.1.6 Descriptive statistics: summary

The results of the isiXhosa and isiZulu groups were compared for the L1 and English variables. This analysis showed that, for the most part, the groups did not differ extensively on the phonological processing variables (L1 or English) or English literacy variables. Where the groups did differ, these differences in the observed variables represented a small effect: the isiXhosa group had higher scores on the L1 LRF and word reading tasks, the isiZulu group had better English sight word reding scores than the isiXhosa group, the isiZulu group also scored higher on L1 PWM and English digit span, and the isiZulu group remained faster in naming English colours and objects.

5.3.2 Correlations between variables within and across-languages per group

The within language correlations are presented first for L1 (*Table 5-4*) then English (*Table 5-5*). The final two sections address the cross-language correlations for the isiXhosa (*Table 5-6*) and isiZulu (*Table 5-7*) groups.

5.3.2.1 L1 within-language correlations

The L1 within-language Pearson correlations are presented in *Table 5-4*. The correlations for the isiXhosa group are presented below the diagonal and for the isiZulu group above the diagonal.

The PA tasks correlated moderately to strongly with one another (r = .53 - .72), with slightly stronger correlations in the isiZulu group. The literacy tasks were also correlated moderately to strongly with one another, with most correlations being very strong (r > .70) and of similar magnitude in both groups. The PA- Literacy correlations were also moderate to very strong for both groups (r = .40 - .82), and stronger for most correlations in the isiZulu group. The RAN-Literacy correlations were moderate to strong (r = -.40 – -.70) for RAN letters, and small to medium (r = -.10 – -.40) (and sometimes nonsignificant) for RAN Objects. The correlation between RAN letters and objects was moderate in the isiXhosa group (r = .46) but weak (r = .23) in the isiZulu group. L1 digit span and NWR were moderately correlated (r = .35) in the isiXhosa group, but very weakly (r = .08) correlated in the isiZulu group. NWR had very weak and mostly non-significant correlations with literacy for the isiXhosa group. Digit span had weak to moderate correlations (r = .20 - .50) with literacy. NWR had very weak correlations (r < .22) with literacy in the isiXhosa group, and weak correlations with literacy in the isiZulu group (r < .34).

Table 5-4. Pearson correlations between L1 variables for the isiXhosa (below diagonal) and isiZulu (above diagonal) groups at the start of grade 3

	Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1	**PA: Blending**	-	.72***	.64***	.40**	.18	-.58***	-.41**	.70***	.60***	.76***	.71***	.71***	.76***	.56***	.61***	.51***	.77***
2	**PA: Elision**	.63***	-	.67***	.31*	.22	-.55***	-.39**	.74***	.68***	.80***	.77***	.77***	.82***	.67***	.74***	.69***	.86***
3	**PA: Isolation**	.53***	.58***	-	.45***	.27*	-.56***	-.35**	.72***	.70***	.65***	.64***	.64***	.65***	.50***	.67***	.49***	.69***
4	**PWM: Digit Span**	.37**	.46***	.35**	-	.08	-.25	-.38**	.53***	.37**	.40**	.38**	.33**	.39**	.24	.39**	.11	.40**
5	**PWM: NWR**	.13	.18	.14	.35**	-	-.16	-.38**	.15	.14	.27*	.29*	.33**	.30*	.13	.23	-.05	.25
6	**RAN: Letters**	-.48***	-.40**	-.64***	-.21	-.03	-	.23	-.64***	-.62***	-.59***	-.50***	-.47***	-.53***	-.40**	-.51***	-.31*	-.53***
7	**RAN: Objects**	-.19	-.28*	-.26*	-.29*	-.08	.46***	-	-.45***	-.38**	-.33**	-.35**	-.31*	-.32*	-.27*	-.31*	-.16	-.38**
8	**Literacy: LRF**	.55***	.58***	.56***	.30*	.03	-.75***	-.41***	-	.80***	.84***	.78***	.72***	.79***	.58***	.79***	.41**	.81***
9	**Literacy: Letter Accuracy**	.56***	.43***	.50***	0.21	.07	-.74***	-.28*	.80***	-	.73***	.59***	.58***	.69***	.55***	.79***	.42***	.71***
10	**Literacy: Reg Word Acc**	.72***	.64***	.60***	.35**	.13	-.67***	-.26*	.82***	.78***	-	.86***	.84***	.95***	.65***	.83***	.52***	.91***
11	**Literacy: Reg Word Flu**	.52***	.72***	.64***	.55***	.02	-.54***	-.33**	.75***	.50***	.71***	-	.97***	.84***	.52***	.67***	.54***	.87***
12	**Literacy: Text Fluency**	.53***	.73***	.64***	.49***	.03	-.53***	-.34**	.77***	.50***	.71***	.96***	-	.86***	.48***	.64***	.58***	.87***
13	**Literacy: Text Accuracy**	.63***	.64***	.53***	.43***	.20	-.55***	-.25*	.76***	.64***	.85***	.72***	.81***	-	.62***	.79***	.54***	.91***
14	**Literacy: Can spell 'imoto'**	.59***	.55***	.57***	.24	.18	-.59***	-.16	.70***	.74***	.86***	.55***	.56***	.74***	-	.79***	.42***	.60***
15	**Literacy: Partial Spelling 'imoto'**	.57***	.48***	.56***	.21	.14	-.70***	-.24	.76***	.88***	.88***	.55***	.55***	.72***	.91***	-	.42***	.78***
16	**Literacy: Can spell 'indlebe'**	.41***	.60***	.54***	.44***	.21	-.45***	-.19	.57***	.41***	.59***	.58***	.66***	.67***	.49***	.45***	-	.69***
17	**Literacy: Partial Spelling 'indlebe'**	.62***	.69***	.69***	.40**	.18	-.64***	-.30*	.79***	.69***	.87***	.71***	.74***	.81***	.74***	.75***	.79***	-

Notes: * p < .05; ** p < .01; *** p < .001. The p values have not been adjusted for multiple comparisons. Flu – fluency; Acc – accuracy.

5.3.2.2 English within-language correlations

The English within-language correlations are presented in *Table 5-5*. The correlations for the isiXhosa group are presented below the diagonal and for the isiZulu group above the diagonal.

The correlations between variables varied in their strength by language group with correlations often being stronger for the isiZulu group. The English PA tasks correlated strongly (r = .62 - .82) in the isiZulu group and moderately to strongly in the isiXhosa group (r = .39 - .67). The same pattern was seen for the RAN tasks with stronger correlations in the isiZulu (r = .62 - .81) than the isiXhosa group (r = .30 - .56). For the PWM tasks, the correlation was stronger in the isiXhosa group (r = .56) than the isiZulu group (r = .31). The reading tasks were very strongly correlated with one another (r > .70), and the spelling tasks were strongly correlated with one another (r > .60).

The PA-literacy correlations were moderate to strong (r = .40 - .75), and slightly stronger in the isiZulu than the isiXhosa group. The NWR-literacy correlations (r < .30) were weak in both groups. The English digit span task had mostly weak correlations (r < .37) with literacy tasks in the isiXhosa group, but moderate correlations (most correlations at least .40 and up to .50) with literacy in the isiZulu group. The RAN literacy correlations were moderate (around -.35) for both groups, with the exception of RAN objects which had weak correlations (r < .27) with literacy for the isiXhosa group.

Table 5-5. Pearson correlations between English variables for the isiXhosa (below diagonal) and isiZulu (above diagonal) groups at the start of grade 3

	Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	**PA: Blending**	-	.66***	.82***	.51***	.36**	-.39**	-.37**	-.44***	.62***	.51***	.64***	.57***	.63***	.56***	.60***	.56***	.56***	.63***	.28*	.61***
2	**PA: Elision**	.39**	-	.76***	.55***	.30*	-.39**	-.42***	-.38**	.74***	.70***	.75***	.75***	.72***	.67***	.71***	.64***	.47***	.55***	.49***	.65***
3	**PA: Isolation**	.54***	.67***	-	.65***	.34**	-.43***	-.50***	-.47***	.72***	.60***	.73***	.63***	.73***	.61***	.67***	.75***	.61***	.74***	.31*	.68***
4	**PWM: Digit Span**	.02	.15	.32*	-	.31*	-.20	-.20	-.28*	.45***	.40**	.44***	.47***	.50***	.49***	.51***	.48***	.39**	.49***	0.05	.40**
5	**PWM: NWR**	-0.1	.29*	.28*	.56***	-	-.20	-.10	-.30*	.23	.15	.18	.17	.21	.16	.14	.10	.03	.13	.11	.11
6	**RAN: Colours**	-.34**	-.35**	-.41**	-.20	-.10	-	.71***	.81***	-.30*	-.27*	-.28*	-.20	-.34**	-.26*	-.32*	-.43***	-.20	-.38**	-.10	-.31*
7	**RAN: Digits**	-.34**	-.42***	-.54***	-.20	-.10	.56***	-	.62***	-.48***	-.46***	-.41**	-.37**	-.48***	-.41**	-.46***	-.55***	-.34**	-.45***	-.20	-.41**
8	**RAN: Objects**	-.30*	-.35**	-.35**	-.20	-.20	.39**	.30*	-	-.33*	-.29*	-.33**	-.30*	-.37**	-.29*	-.36**	-.46***	-.34**	-.42***	-.10	-.32*
9	**Literacy: NW Accuracy**	.48***	.56***	.74***	.30*	.25*	-.37**	-.43***	-.10	-	.90***	.89***	.76***	.89***	.78***	.80***	.75***	.56***	.67***	.64***	.77***
10	**Literacy: NW Fluency**	.49***	.48***	.58***	.21	.19	-.37**	-.38**	-.20	.80***	-	.85***	.87***	.85***	.90***	.86***	.67***	.52***	.58***	.69***	.75***
11	**Literacy: Reg Accuracy**	.35**	.58***	.68***	.36**	.26*	-.35**	-.39**	-.10	.79***	.68***	-	.87***	.93***	.85***	.87***	.77***	.67***	.70***	.68***	.87***
12	**Literacy: Reg Fluency**	.32*	.53***	.59***	.32*	.27*	-.32*	-.34**	-.20	.72***	.84***	.89***	-	.85***	.94***	.94***	.63***	.54***	.56***	.68***	.75***
13	**Literacy: SW Accuracy**	.37**	.55***	.66***	.37**	.32*	-.41**	-.41***	-.27*	.74***	.74***	.80***	.84***	-	.90***	.90***	.82***	.66***	.74***	.64***	.86***
14	**Literacy: SW Fluency**	.33**	.53***	.58***	.36**	.34**	-.33**	-.35**	-.26*	.69***	.86***	.71***	.86***	.92***	-	.94***	.67***	.61***	.62***	.67***	.78***
15	**Literacy: Text Fluency**	.47***	.61***	.68***	.27*	.18	-.39**	-.41***	-.26*	.74***	.85***	.81***	.89***	.82***	.86***	-	.79***	.61***	.64***	.60***	.83***
16	**Literacy: Text Accuracy**	.50***	.62***	.76***	.23	.19	-.37**	-.53***	-.20	.79***	.61***	.67***	.57***	.59***	.52***	.72***	-	.58***	.72***	.36**	.73***
17	**Literacy: can spell 'dog'**	.33**	.54***	.59***	.25	.22	-.20	-.28*	.00	.58***	.43***	.56***	.47***	.51***	.44***	.53***	.62***	-	.86***	.38**	.78***
18	**Literacy: Partial Spelling 'dog'**	.49***	.61***	.72***	.27*	.18	-.29*	-.46***	-.10	.74***	.55***	.63***	.50***	.55***	.46***	.60***	.81***	.81***	-	.33*	.74***
19	**Literacy: can spell 'sheep'**	.27*	.21	.36**	.21	.04	-.3	-.20	-.20	.32*	.50***	.48***	.58***	.50***	.51***	.66***	.28*	.13	.24	-	.60***
20	**Literacy: Partial Spelling 'sheep'**	.34**	.43***	.51***	.17	.14	-.27*	-.48***	-.10	.56***	.65***	.60***	.61***	.57***	.56***	.69***	.62***	.52***	.69***	.51***	-

Notes: * $p < .05$; ** $p < .01$; *** $p < .001$. NWR – Nonword Repetition; NW – Nonword Reading; Reg – Regular Word Reading; SW – Sight Word Reading. The p values have not been adjusted for multiple comparisons.

5.3.2.3 Across-language correlations

The across-language correlations for the isiXhosa group are presented in *Table 5-6*and those for the isiZulu group are presented in *Table 5-7*. In these tables, the L1 variables are listed in the header row, and the English variables are listed in the first column.

The PA tasks had strong across-language correlations with one another (r > .60) which were stronger in the isiZulu group. English blending had a weak correlation (r < .35) with L1 PA for the isiXhosa group. The across language correlations for PWM differed by group. For the isiXhosa group, L1 and English digit span were strongly correlated (r = .69), and English NWR had a moderate correlation with L1 PWM tasks (r = .26 - .43). English digit span had a weak correlation with L1 NWR (r = .10). The correlations were much weaker in the isiZulu group: L1 and English digit span had a moderate correlation (r = .46), and the other tasks had a weak correlation (r < .23). The RAN tasks were moderately to strongly correlated with each other (r = .40 - .65) in both groups, with the exception of English RAN objects for the isiXhosa group which had weak correlations (r < .26) with the other RAN tasks.

The PA-literacy correlations were stronger in the isiZulu than isiXhosa group. For the isiXhosa group, the PA-literacy correlations were moderate to strong (r = .40 – 72), and for the isiZulu group, these correlations were strong to very strong (r = .50 - .79). NWR had very weak to weak correlations with literacy (r < .30) in both groups. Digit span had a moderate to strong correlation with literacy across languages. For the isiXhosa group, the digit span - literacy correlation was moderate to strong (r = .30 – .60) for L1 digit span and weak (r < .35) for English digit span. For the isiZulu group, English digit span was moderately to strongly correlated (r = .40 - .60), and L1 digit span was weakly correlated (r < .40). RAN had moderate across-language correlations, with correlations tending towards strong for alphanumeric tasks (digits and letters). For the isiXhosa group, English RAN objects was not significant for across language literacy tasks.

Table 5-6. Cross-language Pearson correlations between variables for the isiXhosa group at the start of grade 3

L1	PA: Blending	PA: Elision	PA: Isolation	PWM: Digit Span	PWM: NWR	RAN: Letters	RAN: Objects	Literacy: LRF	Literacy: Letter Reading Accuracy	Literacy: Reg Word Accuracy	Literacy: Reg Word Fluency	Literacy: Text Fluency	Literacy: Text Accuracy	Literacy: Can spell 'imoto'	Literacy: Partial Spelling 'imoto'	Literacy: Can spell 'indlebe'	Literacy: Partial Spelling 'indlebe'
English																	
PA: Blending	.33*	.29*	.32*	0.16	.13	-.40**	-.33**	.58***	.37**	.45***	.41**	.39**	.32*	.42***	.43***	.26*	.38**
PA: Elision	.53***	.62***	.64***	.32*	.22	-.52***	-.33*	.59***	.49***	.61***	.66***	.67***	.56***	.49***	.50***	.49***	.64***
PA: Isolation	.65***	.58***	.66***	.34**	.10	-.64***	-.41**	.68***	.53***	.71***	.62***	.66***	.65***	.65***	.65***	.57***	.68***
PWM: Digit Span	.29*	.41***	.27*	.69***	.10	-.26*	-0.22	.26*	.23	.30*	.34**	.29*	.27*	.20	.22	.35**	.33**
PWM: NWR	.29*	.46***	.25	.43***	.26*	-.24	-.01	.12	.11	.23	.22	.20	.17	.20	.17	.34**	.29*
RAN: Colours	-0.2	-.26*	-.32*	-.21	.00	.59***	.60***	-.45***	-.33**	-.30*	-.35**	-.33**	-.27*	-.20	-.31*	-.24	-.34**
RAN: Digits	-.52***	-.37**	-.41***	-.20	.10	.65***	.49***	-.60***	-.52***	-.54***	-.48***	-.47***	-.44***	-.42***	-.46***	-.34**	-.50***
RAN: Objects	-.20	-.22	-.22	-.18	.00	.25*	.23	-.28*	-.12	-.13	-.25	-.25	-.05	-.06	-.08	-.11	-.15
Literacy: NW Accuracy	.61***	.57***	.46***	.46***	.14	-.56***	-.34**	.69***	.64***	.76***	.67***	.66***	.75***	.71***	.71***	.50***	.67***
Literacy: NW Fluency	.41**	.46***	.39**	.50***	.11	-.45***	-.37**	.58***	.42***	.53***	.71***	.61***	.54***	.44***	.46***	.38**	.47***
Literacy: Reg Accuracy	.51***	.65***	.60***	.52***	.10	-.49***	-.39**	.61***	.47***	.60***	.73***	.74***	.64***	.52***	.49***	.69***	.71***
Literacy: Reg Fluency	.43***	.59***	.54***	.61***	.14	-.40**	-.37**	.52***	.35**	.49***	.77***	.71***	.53***	.41**	.38**	.55***	.57***
Literacy: SW Accuracy	.53***	.58***	.49***	.57***	.11	-.50***	-.37**	.61***	.42***	.55***	.76***	.74***	.57***	.39**	.41***	.54***	.55***
Literacy: SW Fluency	.42***	.55***	.40**	.56***	.11	-.41**	-.34**	.54***	.33**	.45***	.73***	.68***	.49***	.31*	.33**	.45***	.46***
Literacy: Text Fluency	.47***	.67***	.57***	.51***	.01	-.47***	-.43***	.66***	.42***	.58***	.88***	.85***	.62***	.49***	.47***	.53***	.60***
Literacy: Text Accuracy	.72***	.65***	.62***	.30*	.16	-.64***	-.33**	.80***	.68***	.86***	.71***	.73***	.82***	.81***	.80***	.60***	.80***
Literacy: can spell 'dog'	.51***	.48***	.47***	.37**	.18	-.37**	-.21	.53***	.46***	.64***	.50***	.57***	.69***	.57***	.52***	.58***	.61***
Literacy: Partial Spelling 'dog'	.61***	.54***	.63***	.38**	.12	-.59***	-.27*	.77***	.70***	.86***	.64***	.68***	.82***	.82***	.80***	.57***	.79***
Literacy: can spell 'sheep'	.21	.36**	.38**	.40**	-.13	-.18	-.20	.28*	.13	.22	.61***	.57***	.23	.16	.15	.33**	.27*

L1	PA: Blending	PA: Elision	PA: Isolation	PWM: Digit Span	PWM: NWR	RAN: Letters	RAN: Objects	Literacy: LRF	Literacy: Letter Reading Accuracy	Literacy: Reg Word Accuracy	Literacy: Reg Word Fluency	Literacy: Text Fluency	Literacy: Text Accuracy	Literacy: Can spell 'imoto'	Literacy: Partial Spelling 'imoto'	Literacy: Can spell 'indlebe'	Literacy: Partial Spelling 'indlebe'
Literacy: Partial Spelling 'sheep'	.53***	.58***	.57***	.38**	-.10	-.53***	-.30*	.67***	.55***	.69***	.72***	.70***	.62***	.54***	.58***	.55***	.70***

Notes: * p < .05; ** p < .01; *** p < .001. NWR – Nonword Repetition; NW – Nonword Reading; Reg – Regular Word Reading; SW – Sight Word Reading. The p values have not been adjusted for multiple comparisons.

Table 5-7. Cross-language Pearson correlations between variables for the isiZulu group at the start of grade 3

L1	PA: Blending	PA: Elision	PA: Isolation	PWM: Digit Span	PWM: NWR	RAN: Letters	RAN: Objects	Literacy: LRF	Literacy: Letter Reading Accuracy	Literacy: Reg Word Accuracy	Literacy: Reg Word Fluency	Literacy: Text Fluency	Literacy: Text Accuracy	Literacy: Can spell 'imoto'	Literacy: Partial Spelling 'imoto'	Literacy: Can spell 'indlebe'	Literacy: Partial Spelling 'indlebe'
English																	
PA: Blending	.64***	.67***	.51***	.36**	.04	-.44***	-.38**	.60***	.48***	.59***	.60***	.58***	.59***	.54***	.53***	.58***	.67***
PA: Elision	.71***	.76***	.60***	.37**	.18	-.49***	-.37**	.62***	.55***	.65***	.69***	.69***	.65***	.39**	.56***	.53***	.73***
PA: Isolation	.69***	.77***	.69***	.39**	.16	-.56***	-.41**	.78***	.68***	.77***	.67***	.65***	.73***	.60***	.74***	.48***	.79***
PWM: Digit Span	.44***	.49***	.48***	.46***	.18	-.20	-.30*	.60***	.44***	.58***	.53***	.50***	.55***	.44***	.56***	.25	.59***
PWM: NWR	.19	.23	.24	.21	.21	.01	-.30*	.25	.20	.16	.14	.15	.15	.14	.17	.18	.20
RAN: Colours	-.50***	-.39**	-.44***	-.29*	-.33*	.45***	.61***	-.43***	-.35**	-.30*	-.30*	-.27*	-.30*	-.30*	-.39**	-0.08	-.33*
RAN: Digits	-.50***	-.47***	-.52***	-.26	-.33*	.65***	.44***	-.56***	-.50***	-.55***	-.49***	-.45***	-.49***	-.33*	-.50***	-0.17	-.49***
RAN: Objects	-.49***	-.37**	-.43***	-.39**	-.23	.40**	.72***	-.48***	-.47***	-.33**	-.33**	-.31*	-.34**	-0.22	-.37**	-0.15	-.41**
Literacy: NW Accuracy	.75***	.78***	.67***	.34**	.27*	-.55***	-.28*	.70***	.67***	.84***	.83***	.86***	.81***	.55***	.71***	.59***	.83***
Literacy: NW Fluency	.67***	.69***	.56***	.34**	.22	-.47***	-.27*	.65***	.56***	.75***	.88***	.87***	.70***	.44***	.60***	.49***	.73***

L1	PA: Blending	PA: Elision	PA: Isolation	PWM: Digit Span	PWM: NWR	RAN: Letters	RAN: Objects	Literacy: LRF	Literacy: Letter Reading Accuracy	Literacy: Reg Word Accuracy	Literacy: Reg Word Fluency	Literacy: Text Fluency	Literacy: Text Accuracy	Literacy: Can spell 'imoto'	Literacy: Partial Spelling 'imoto'	Literacy: Can spell 'indlebe'	Literacy: Partial Spelling 'indlebe'
Literacy: Reg Accuracy	.72***	.77***	.67***	.35**	.25	-.49***	-.28*	.70***	.62***	.80***	.89***	.92***	.78***	.50***	.64***	.61***	.86***
Literacy: Reg Fluency	.63***	.66***	.54***	.34**	.25*	-.38**	-.33*	.61***	.49***	.67***	.88***	.87***	.64***	.38**	.50***	.47***	.71***
Literacy: SW Accuracy	.73***	.77***	.65***	.35**	.33*	-.48***	-.36**	.72***	.61***	.86***	.91***	.92***	.85***	.55***	.68***	.54***	.87***
Literacy: SW Fluency	.62***	.68***	.54***	.32*	.31*	-.39**	-.34**	.62***	.49***	.72***	.92***	.89***	.69***	.46***	.56***	.45***	.74***
Literacy: Text Fluency	.70***	.72***	.65***	.33**	.29*	-.46***	-.36**	.70***	.58***	.77***	.93***	.91***	.75***	.45***	.61***	.51***	.79***
Literacy: Text Accuracy	.70***	.78***	.73***	.37**	.25	-.56***	-.31*	.79***	.79***	.84***	.76***	.76***	.83***	.56***	.82***	.48***	.85***
Literacy: can spell 'dog'	.56***	.63***	.55***	.36**	.18	-.37**	-.30*	.63***	.49***	.65***	.70***	.68***	.65***	.46***	.59***	.49***	.74***
Literacy: Partial Spelling 'dog'	.63***	.69***	.66***	.47***	0.22	-.48***	-.35**	.73***	.65***	.73***	.71***	.69***	.74***	.62***	.79***	.43***	.77***
Literacy: can spell 'sheep'	.31*	.36**	.27*	-0.02	.28*	-.20	-.11	.19	.22	.37**	.58***	.65***	.36**	.06	.22	.39**	.43***
Literacy: Partial Spelling 'sheep'	.70***	.74***	.64***	.28*	.22	-.49***	-0.24	.71***	.54***	.74***	.85***	.84***	.72***	.43***	.59***	.58***	.81***

Notes: * p < .05; ** p < .01; *** p < .001. NWR – Nonword Repetition; NW – Nonword Reading; Reg – Regular Word Reading; SW – Sight Word Reading. The p values have not been adjusted for multiple comparisons.

5.3.2.4 *Correlation analysis: summary*

The correlations between the indicator variables were similar in size within the L1 for the isiXhosa and isiZulu groups. However, the within English correlations were generally stronger for the isiZulu group. With regards to the across-language correlations, these also tended to be slightly larger for the isiZulu group. Some tasks had particularly weak correlations. These were NWR for both groups, and English RAN objects for the isiXhosa group.

5.3.3 Confirmatory factor analysis of bilingual dimensionality

As indicated in the data analysis procedures (chapter 3 section 3.8.3.1), confirmatory factor analysis models were fit to the data to determine the bilingual dimensionality of each phonological processing construct, and whether this model fit both language groups. The dimensionality of each construct, specifically whether the bilingual tests represented language specific, or language general constructs is established for each phonological processing construct (PA, PWM and RAN) in the following sections. For each construct, the model was fit to the whole sample, and then a multigroup CFA (MGCFA) was fit to determine whether the same model fit both groups.

5.3.3.1 *Dimensionality of PA*

A two-factor (language specific) model and a one-factor (language general) model of the PA data were compared (*Figure 5-7*). Each model included residual correlations for the same tasks in each language as was done for the grade 1 data (presented in chapter 4). Both models had poor fit, so modification indices were inspected. Including an additional residual correlation between English blending and English isolation improved model fit for both models. The fit statistics for the two-factor model were: scaled χ^2 (4) = 1.397, p = .845, scaling factor = 0.856, robust CFI = 1.000, robust TLI = 1.020, robust RMSEA = 0.000, 90% CI [0; .71], SRMR = .008. The fit statistics for the one factor model were: scaled χ^2 (5) = 3.859, p = .570, scaling factor = 0.929, robust CFI = 1.000, robust TLI = 1.008, robust RMSEA = 0.000, 90% CI [0; .106], SRMR = .013.

Both models were subjected to measurement invariance testing and were invariant at the scalar level. Thus, the relationships between the indicators and factors were equivalent for both language groups. The chi square difference test indicated that there was no significant difference between the one and two factor configural models, supporting that the one factor model was preferred as it had more degrees of freedom (i.e., was more parsimonious), $\Delta\chi^2$ = 1.96, Δdf = 1, p = .162. With scalar equivalence, the one factor model was also preferred, $\Delta\chi^2$ = 4.31, Δdf = 4, p = .365. Additional evidence that the PA indicators loaded on one factor is that in the two-factor model, the latent correlation between L1 and English PA was .95. That is, after accounting for shared method variance/error, L1 and English PA correlate almost perfectly, suggesting that they represent the same underlying factor. The indicators had high loadings on the factor, with a moderate loading only for English blending in the one factor model.

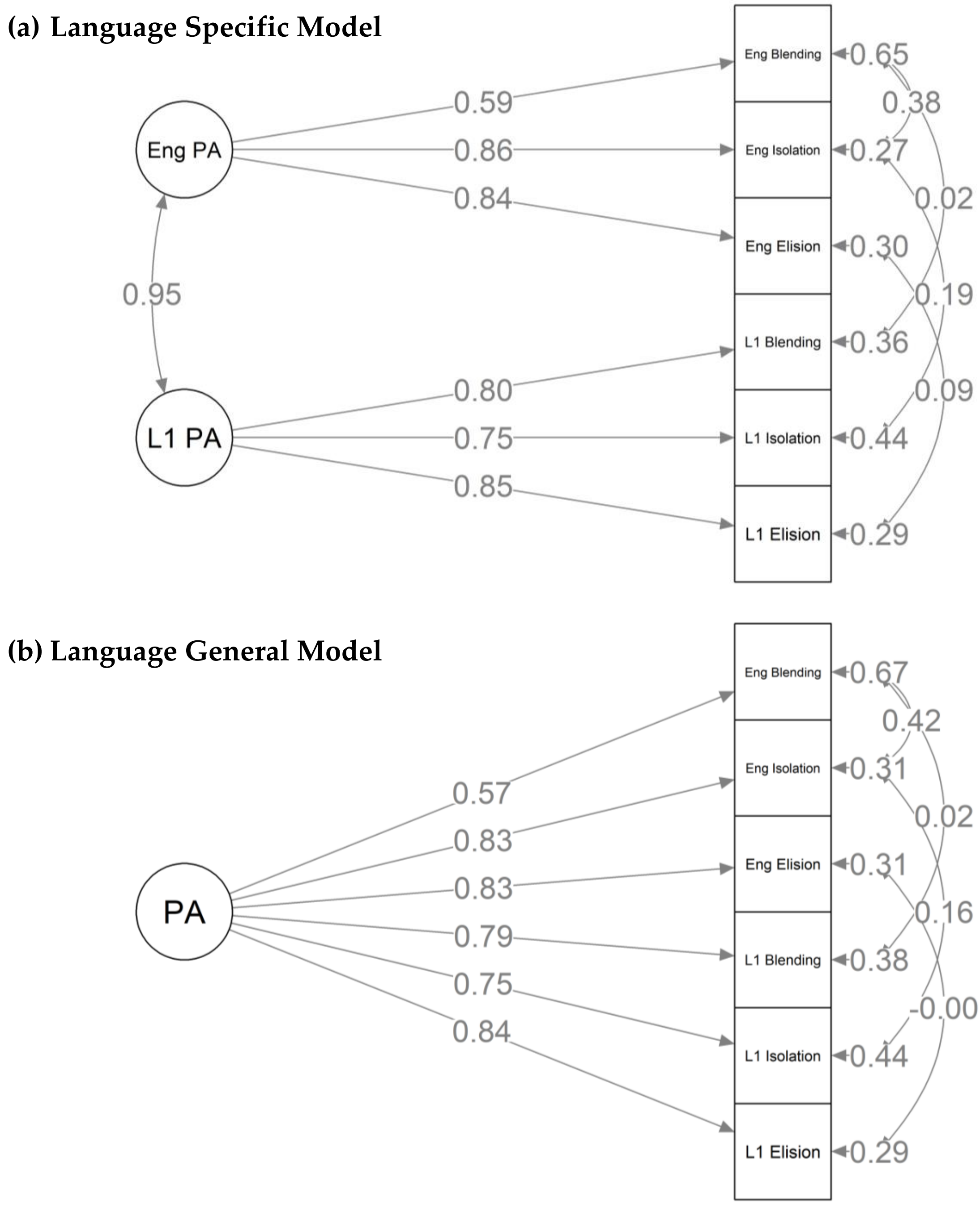


Figure 5-7. Language specific (a) and language general (b) configural models of bilingual PA at the start of grade 3

5.3.3.2 Dimensionality of PWM

One language specific and two language general models (task specific, and task general) were fit to the data. The language specific model (one factor per language) did not fit the data well, producing an error that the correlation estimated between the latent variables exceeded 1, indicating the need to find an alternate model. The language general model with two factors (NWR, Digit Span) fit the data well, scaled χ^2 (1) = 0.072, p = .789, scaling factor = 1.331, robust CFI = 1.000, robust TLI = 1.145, robust RMSEA = 0.000, 90% CI [0; .179], SRMR = .005. The language and task general model also fit the data well, scaled χ^2 (2) = 0.809, p = .667, scaling factor = 1.123, robust CFI = 1.000, robust TLI = 1.078, robust RMSEA = 0.000, 90% CI [0; .146], SRMR = .018. These models are presented in *Figure 5-8*. The chi-square difference test was not significant supporting the one factor model, $\Delta\chi^2$ = 0.889, Δdf = 1, p = .346.

MGCFA models were fit to the data. The model was not supported for the language general task specific model. The model fit poorly for the language and task general one factor model, scaled χ^2 (4) = 13.339, p = .010, scaling factor = 1.030, robust CFI = 0.893, robust TLI = 0.678, robust RMSEA = 0.199, 90% CI [0.087; 0.321], SRMR = .049. Thus, the factor structure did not apply to both language groups. I inspected the correlations for PWM. The correlations were quite different for each group with NWR correlating weakly and mostly non significantly with other variables. The isiZulu group had stronger correlations between English digit span and other variables, and the isiXhosa group had stronger correlations between L1 digit span and other variables. Thus, in the final path analysis, I used only the indicators for digit span.

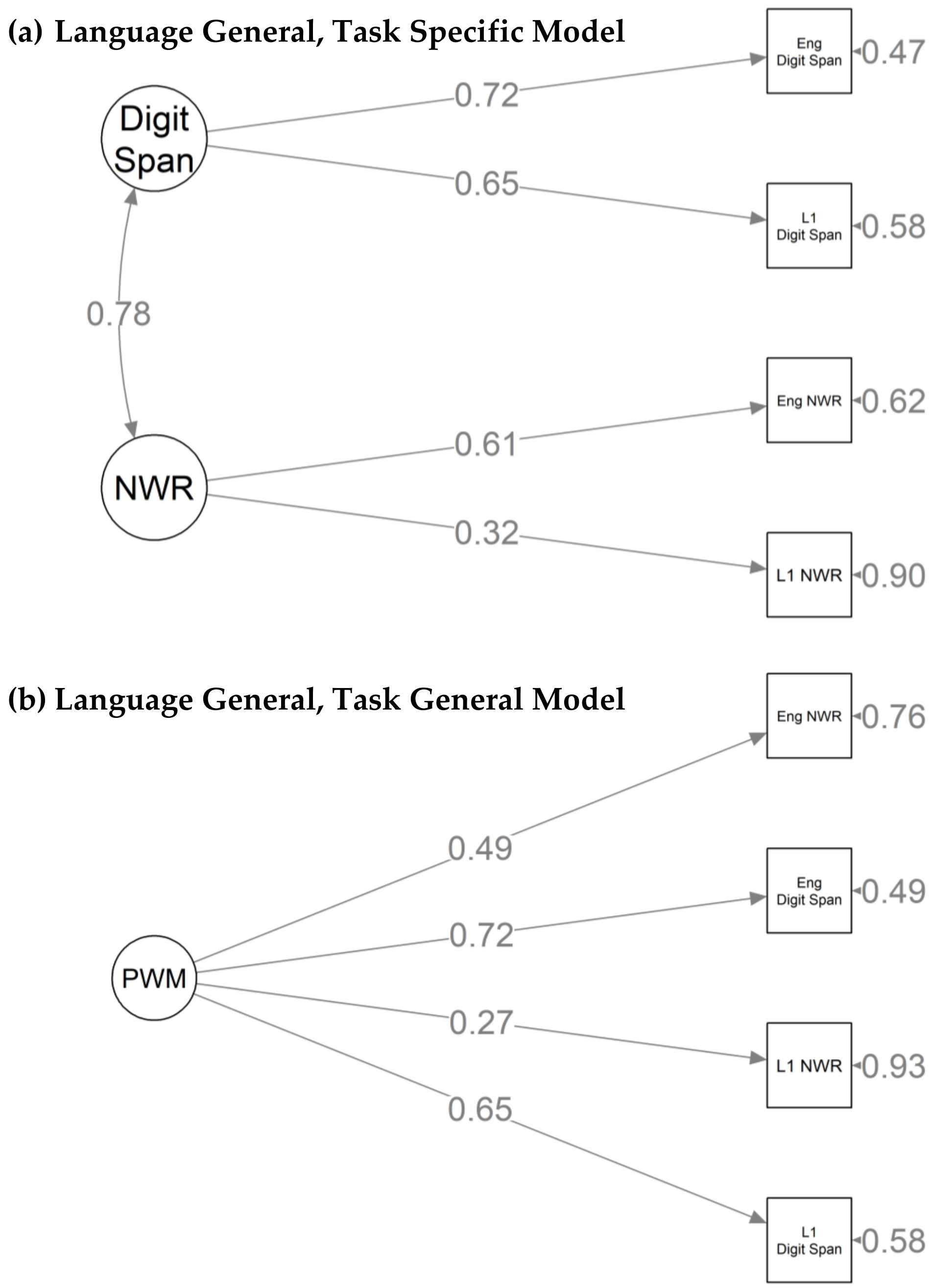


Figure 5-8. Language general configural models of bilingual PWM that are task specific (a) and task general (b) at the start of grade 3

5.3.3.3 Dimensionality of RAN

The CTOPP presents RAN as two factors: alphanumeric and non-alphanumeric. Alphanumeric tasks have stronger correlations with reading due to the shared alphanumeric nature of both tasks, and because non-alphanumeric tasks include semantic processing. Nevertheless, if the specific RAN tasks are not of interest, all these tasks should load on one RAN factor, independent of language.

I tested two factor (alphanumeric and non-alphanumeric) and one factor language general models given research demonstrating that RAN is a similar indicator in L1 and L2 given sufficient familiarity with the items (Gottardo et al., 2021)[29]. The two-factor model included a latent factor correlation between alphanumeric and non-alphanumeric factors (*Figure 5-9*). The fit of the two-factor model was excellent, scaled χ^2 (4) = 1.787, p = .775, scaling factor = 1.268, robust CFI = 1.0, robust TLI = 1.027, robust RMSEA = 0.0, 90% CI [0.0; 0.103], SRMR = .016. The configural model for each group did not fit well but model fit was improved by including correlated residuals for L1 and English RAN objects. Constraining the loadings to be equal resulted in a model not significantly different from the configural model, scaled χ^2 (9) = 2.338, p = .984, scaling factor = 1.033, robust CFI = 1.0, robust TLI = 1.054, robust RMSEA = 0.0, 90% CI [0.0; 0.0], SRMR = .025. However, the scalar model did not fit, indicating that the intercepts for each group are different. These results suggest that the two-factor model of RAN which includes an alphanumeric and non-alphanumeric factor fits the data with similar factor loadings for the isiXhosa and isiZulu groups.

A one factor RAN general model was also tested (*Figure 5-9*). The inclusion of correlated residuals between English RAN digits and L1 RAN letters, and correlated residuals between L1 and Eng RAN objects resulted in adequate model fit, scaled χ^2 (3) = 1.512, p = .680, scaling factor = 1.188, robust CFI = 1.0, robust TLI = 1.023, robust RMSEA = 0.0, 90% CI [0.0; 0.127], SRMR = .017. This one factor model fit both groups adequately at the configural level, so the loadings were constrained to be equal, and then the intercepts. Only the weak model (loadings equal) fit the data well, scaled χ^2 (10) = 2.550, p = .990, scaling factor = 1.103, robust CFI = 1.0, robust TLI = 1.053, robust RMSEA = 0.0, 90% CI [0.0; 0.127], SRMR = .029. These results suggest that the one-factor model of RAN fits the data with similar factor loadings for the isiXhosa and isiZulu groups.

The one and two factor models were compared using the *anova* function. There was no significant difference suggesting that the models fit the data equally well. The one factor model had more degrees of freedom (i.e., was more parsimonious). However, the loadings of the alphanumeric indicators were lower in the one factor than two factor model. Since the latent correlation between alphanumeric and non-alphanumeric factors was.75 (not enough to say there is a perfect correlation), and the CTOPP conceptualises RAN as two factors, I decided to operationalise RAN as two separate factors in the path analysis.

[29] I also tested a two-factor language specific model, but it did not fit the data.

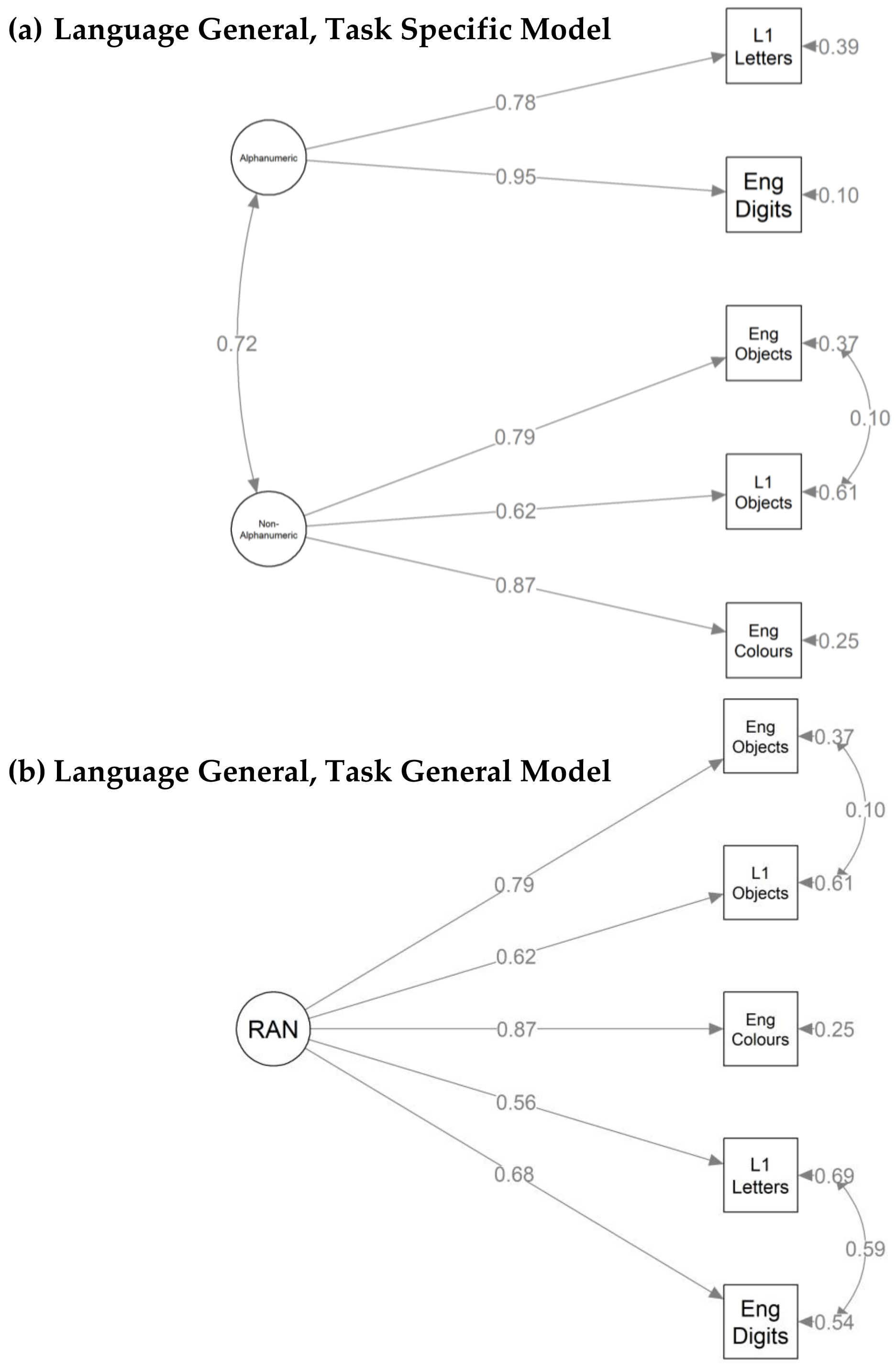


Figure 5-9. Language general task specific (a) and task general (b) models of bilingual RAN at the start of grade 3

5.3.3.4 Summary: Confirmatory factor analysis

The CFA models fit to the PA data revealed that PA was best conceptualised as a language general latent factor at t2. A two factor, language specific model did fit the PA data, but with a very high correlation of .95, suggesting that a one factor model is more parsimonious. As per the t1 findings, PWM loaded on one factor, with low loadings of NWR. Thus, digit span in L1 and English were used for later analysis. A language general model of RAN was preferred. Both a task specific (one factor for alphanumeric RAN and one factor for non-alphanumeric RAN) and task general (one RAN factor) fit the data adequately. However, since the alphanumeric and non-alphanumeric latent correlation was .75, and the literature reveals stronger correlations with literacy for alphanumeric RAN, I opted to use the two-factor language general alphanumeric and non-alphanumeric conceptualisation for the later analysis.

5.3.4 Path analysis

Multigroup path models with all paths left free to vary were fit to the data to establish whether the same model fit both language groups. The correlation between the outcome variables in the model was then constrained to determine whether the correlation was the same for the isiXhosa and isiZulu group. Last, the regressions were constrained to determine whether the concurrent (cross-sectional) relations between phonological processing and literacy skills was the same for each group.

The number of variables in the analysis was reduced using principal components analysis. One PA component was estimated from L1 and English blending, L1 and English elision, and L1 and English isolation. An alphanumeric RAN component was estimated from RAN letters and RAN digits. A non-alphanumeric RAN component was estimated from L1 and English RAN objects and English RAN colours. An L1 reading fluency component was estimated from L1 word reading and oral reading fluency. An English reading fluency component was estimated from English regular word, nonword, and sight word reading fluency and English oral reading fluency. An L1 spelling component was estimated from the partial scores for the two dictated words, and the same was done for the English spelling component. The z-scores of LRF, L1 digit span and English digit span tasks were included as indicators. Two path analyses were fit to the data: one for reading fluency and one for spelling. The phonological processing variables were included as correlated exogenous (predictor) variables and reading/spelling were outcome variables. LRF was included as a mediator between the phonological processing constructs and reading/spelling. The direct, indirect, and total effects were also calculated. The interpretation of path models and how indirect and total effects are estimated is presented in section 4.3.4 in the previous chapter.

The path models were estimated using lavaan (Rosseel, 2012), with the MLR estimator (maximum likelihood estimation with robust (Huber-White) standard errors) to address some non-normality in the data. Rather than remove cases with missing data listwise, the full information maximum likelihood function was used so that data would be used case wise (by setting *missing* to "ML" in the *sem* function). Correlations of exogenous variables were included in the model, but not estimated setting *fixed.x* to false. Four participants who had scores above 3 SD on the reading variables were excluded because they were outliers so 118 cases were available for analysis.

5.3.4.1 Path analysis for reading fluency

A multigroup path model was fit to the data predicting L1 and English reading fluency, with LRF as a mediator (*Figure 5-10*). The model included direct paths from the exogenous (predictor) variables to LRF. Direct paths to L1 and English reading were included for PA and the two RAN variables. A direct path from both digit span tasks was included for L1 reading. In order for the model to have degrees of freedom, only a direct path from English digit span to English reading was included.

The configural model fit the data well, scaled χ^2 (2) = 1.312, p = .519, scaling factor = 1.188, robust CFI = 1.0, robust TLI = 1.033, robust RMSEA = 0.053, 90% CI [0.0; 0.248], SRMR = .006. Constraining the correlation between L1 and English reading to be equal for each group lead to worse model fit than the configural model suggesting that the correlations were not the same for each group, scaled χ^2 (3) = 5.727, p = .126, scaling factor = 1.035, robust CFI = .994, robust TLI = .925, robust RMSEA = 0.126, 90% CI [0.0; 0.283], SRMR = .019, , $\Delta\chi^2$ = 5.99, Δdf = 1, p = .014. The correlation for the outcome variables was left free to vary, and the regressions were constrained to be equal in each group. This model did not fit the data well. Based on the modification indices and that the digit span tasks had different correlations with the other variables, the regressions for L1 and English digit span indicators were left to vary. This model fit the data well and was not significantly different from the configural model, scaled χ^2 (13) = 10.299, p = .669, scaling factor = 1.227, robust CFI = 1.0, robust TLI = 1.02, robust RMSEA = 0.0, 90% CI [0.0; 0.116], SRMR = .034, $\Delta\chi^2$ = 9.0, Δdf = 11, p = .624. The final model per language group is presented in *Figure 5-10*, with correlations in *Table 5-8*. The direct, indirect, and total effects on each outcome, as well as the proportion of variance explained in the outcomes, were calculated (*Table 5-9*).

PA and alphanumeric RAN (a composite of letters and digits) emerged as significant predictors of LRF. LRF had a significant and large effect on L1 and English reading. The effect size was almost half for English reading. PA was a significant direct and indirect predictor of reading in L1 and English. Its total effect was similar for L1 and English reading. Alphanumeric RAN made small and significant contributions to reading only indirectly via LRF, so the total effect was significant only for L1 and not English reading. Digit span was an inconsistent predictor. English digit span made a significant contribution to LRF for the isiZulu group. L1 digit span made a significant contribution to L1 reading only for the isiXhosa group. Non-alphanumeric RAN was not a significant predictor of LRF or word/text reading. Overall, the model explained the variance in reading well and was similar for both groups. However, the model better explained LRF in the isiZulu group. Non-alphanumeric RAN and digit span tasks had stronger correlations with other variables in the isiZulu group (*Table 5-8*).

Table 5-8. Correlations between exogenous variables for the isiXhosa (below diagonal) and isiZulu (above diagonal) groups

	PA	RAN A	RAN NA	L1 digit span	Eng digit span
PA	-	.69	.56	.45	.59
RAN Alphanumeric	.66	-	.61	.34	.30
RAN Non-alphanumeric	.35	.59	-	.42	.23
L1 digit span	.40	.13	.12	-	.45
Eng digit span	.27	.14	.14	.70	-

Notes: PA – phonological awareness; RAN A – rapid automatised naming alphanumeric; RAN NA – rapid automatised naming non-alphanumeric; DS – digit span.

Table 5-9. Direct and indirect effects of phonological processing on LRF (mediator), L1 reading fluency (outcome) and English reading fluency (outcome) at the start of grade 3

Group		LRF		L1 Reading Fluency				English Reading Fluency			
	Var.	**Tot.**	**p**	**Dir.**	**Ind.**	**Tot.**	**p**	**Dir.**	**Ind.**	**Tot.**	**p**
Xhosa	LRF	.	.	**0.39**	.	**0.39**	0.00	**0.23**	.	**0.23**	0.00
	PA	**0.35**	0.00	**0.26**	**0.14**	**0.40**	0.00	**0.33**	**0.08**	**0.41**	0.00
	RAN A	**0.46**	0.00	0.09	**0.18**	**0.27**	0.00	0.00	**0.10**	0.10	0.17
	RAN NA	-0.02	0.73	-0.07	-0.01	-0.08	0.15	0.05	0.00	0.05	0.45
	L1 DS	0.14	0.44	**0.42**	0.06	**0.48**	0.00	.	.	.	.
	Eng DS	0.02	0.91	-0.19	0.01	-0.18	0.28	-0.03	0.01	-0.02	0.82
	R^2	*0.61*				*0.68*				*0.64*	
Zulu	LRF	.	.	**0.39**	.	**0.39**	0.00	**0.23**	.	**0.23**	0.00
	PA	**0.35**	0.00	**0.26**	**0.14**	**0.40**	0.00	**0.33**	**0.08**	**0.41**	0.00
	RAN A	**0.46**	0.00	0.09	**0.18**	**0.27**	0.00	0.00	**0.10**	0.10	0.17
	RAN NA	-0.02	0.73	-0.07	-0.01	-0.08	0.15	0.05	0.00	0.05	0.45
	L1 DS	0.10	0.15	-0.03	0.04	0.01	0.89	.	.	.	.
	Eng DS	**0.13**	0.04	0.04	0.05	0.09	0.20	0.07	0.03	0.1	0.19
	R^2	*0.80*				*0.67*				*0.64*	

Notes: Var. – variable; Dir. – direct effect; Ind. – indirect effect; Tot. – total effect, p – p value for total effect; LRF – LRF; PA – phonological awareness; RAN A – rapid automatised naming alphanumeric; RAN NA – rapid automatised naming non-alphanumeric; DS – digit span. Correlation between L1 and English reading fluency is .47 (isiXhosa group) and .79 (isiZulu group). Numbers in bold indicate significant effects.

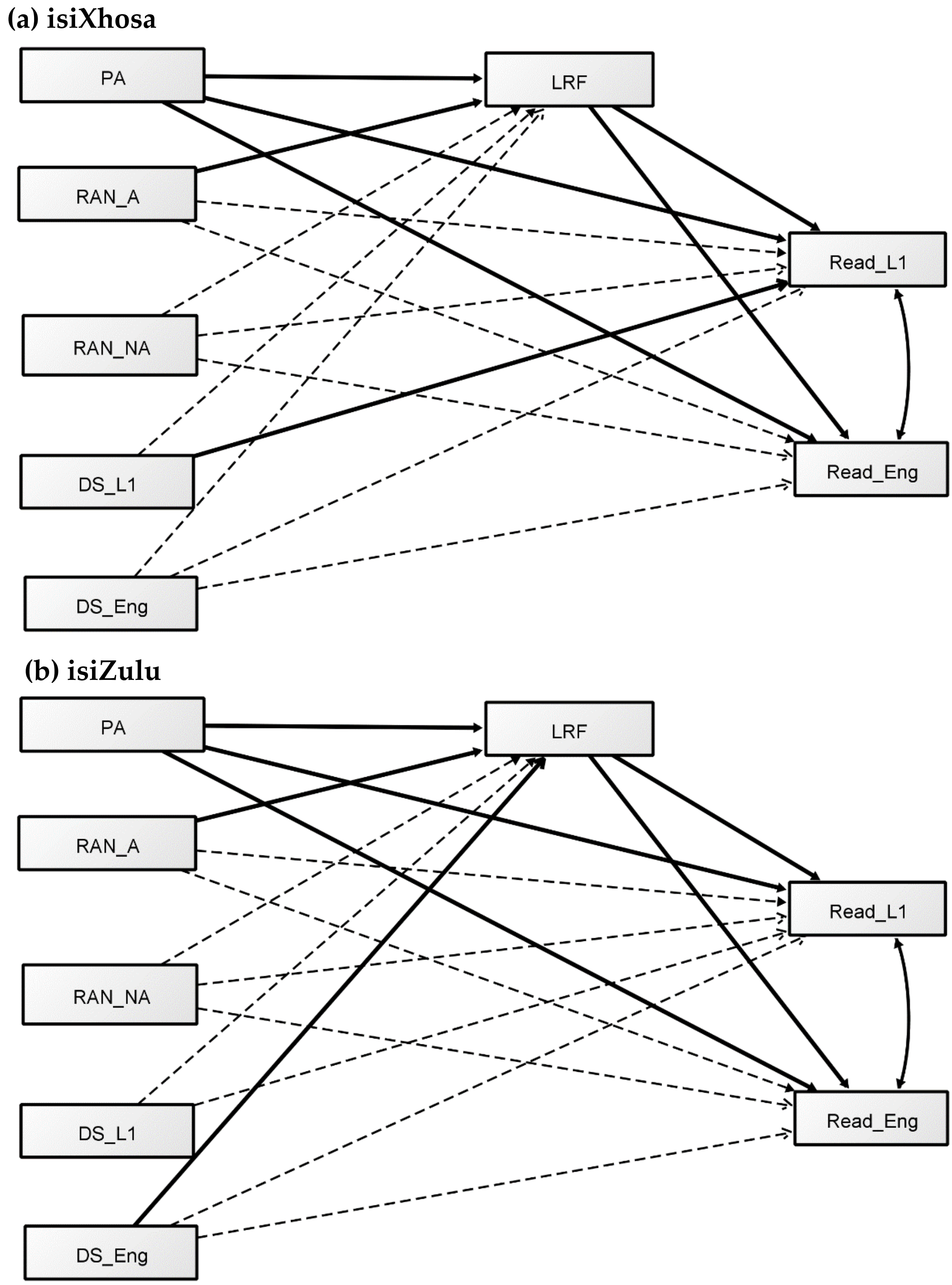


Figure 5-10. Path model fit for the start of grade 3, predicting L1 and English reading fluency with LRF as mediator

Note: scaled χ^2 (13) = 10.299, p = .669, scaling factor = 1.227, robust CFI = 1.0, robust TLI = 1.02, robust RMSEA = 0.0, 90% CI [0.0; 0.116], SRMR = .034. Non-significant direct paths indicated in dashes. Significant direct paths indicated in solid black.

5.3.4.2 *Path analysis for spelling*

A multigroup path model was fit to the data predicting L1 and English spelling, with LRF as a mediator (*Figure 5-11*). The model included direct paths from the exogenous (predictor) variables to LRF. Direct paths to L1 and English spelling were included for PA and the two RAN variables. A direct path from both digit span tasks was included for L1 spelling. In order for the model to have degrees of freedom, only a direct path from English digit span to English spelling was included.

The configural model fit the data well, scaled χ^2 (2) = 1.12, p = .571, scaling factor = 1.109, robust CFI = 1.0, robust TLI = 1.038, robust RMSEA = 0.0, 90% CI [0.0; 0.229], SRMR = .005. The model where the correlation between L1 and English spelling were constrained to be equal for each group fit the data well too, scaled χ^2 (3) = 1.249, p = .741, scaling factor = 1.067, robust CFI = 1.0, robust TLI = 1.048, robust RMSEA = 0.0, 90% CI [0.0; 0.159], SRMR = .005, $\Delta\chi^2$ = 0.09, Δdf = 1, p = .7619. In the next step, the regressions were also constrained to be equal too. This model fit the data well and was not significantly different from the configural model, scaled χ^2 (19) = 10.326, p = .944, scaling factor = 1.003, robust CFI = 1.0, robust TLI = 1.035, robust RMSEA = 0.0, 90% CI [0.0; 0.019], SRMR = .026, $\Delta\chi^2$ = 9.20, Δdf = 17, p = .9337. Thus, the predictors of spelling were equivalent for the two language groups. The direct, indirect, and total effects are presented in *Table 5-10*.

Table 5-10. Direct and indirect effects of phonological processing variables on LRF (mediator), L1 spelling (outcome) and English spelling (outcome) at the start of grade 3

	LRF		**L1 Spelling**				**English Spelling**			
Var.	**Tot.**	**p**	**Dir.**	**Ind.**	**Tot.**	**p**	**Dir.**	**Ind.**	**Tot.**	**p**
LRF	.	.	**0.52**	.	**0.52**	0.000	**0.47**		**0.47**	0.000
PA	**0.36**	0.000	**0.47**	**0.19**	**0.66**	0.000	**0.50**	**0.17**	**0.67**	0.000
RAN A	**0.46**	0.000	0.02	**0.24**	**0.26**	0.001	-0.03	**0.22**	**0.19**	0.015
RAN NA	-0.02	0.724	**-0.12**	-0.01	**-0.13**	0.029	-0.08	-0.01	-0.09	0.197
L1 DS	0.10	0.126	-0.06	0.05	-0.01	0.852	-0.07	.	.	.
Eng DS	0.11	0.062	0.07	0.06	**0.13**	0.013	0.09	0.05	-0.01	0.842
R^2										
isiXhosa	0.62				0.76				0.70	
isiZulu	0.80				0.82				0.67	

Notes: Var. – variable; Dir. – direct effect; Ind. – indirect effect; Tot. – total effect, p – p value for total effect. Correlation between L1 and English spelling is .43 (isiXhosa) and .38 (isiZulu). Numbers in bold indicate significant effects.

Similar to the reading model, PA and alphanumeric RAN were significant predictors of LRF. LRF had a direct effect on L1 and English spelling that was similar in magnitude. PA had a direct and indirect effect on spelling in each language, with approximately two thirds of the effect coming from the direct path. Alphanumeric RAN had only an indirect effect on spelling, and this effect was a third of the size of the total PA effect. Non-alphanumeric RAN had no significant effect on English spelling, but a small negative effect on L1 spelling (which may be a result of suppression). L1 Digit span was not a significant predictor. English digit span made small non-significant direct and indirect effects, which when summed included a small positive effect on L1 spelling. The proportion of variance explained was quite high for both groups and for both L1 and English spelling.

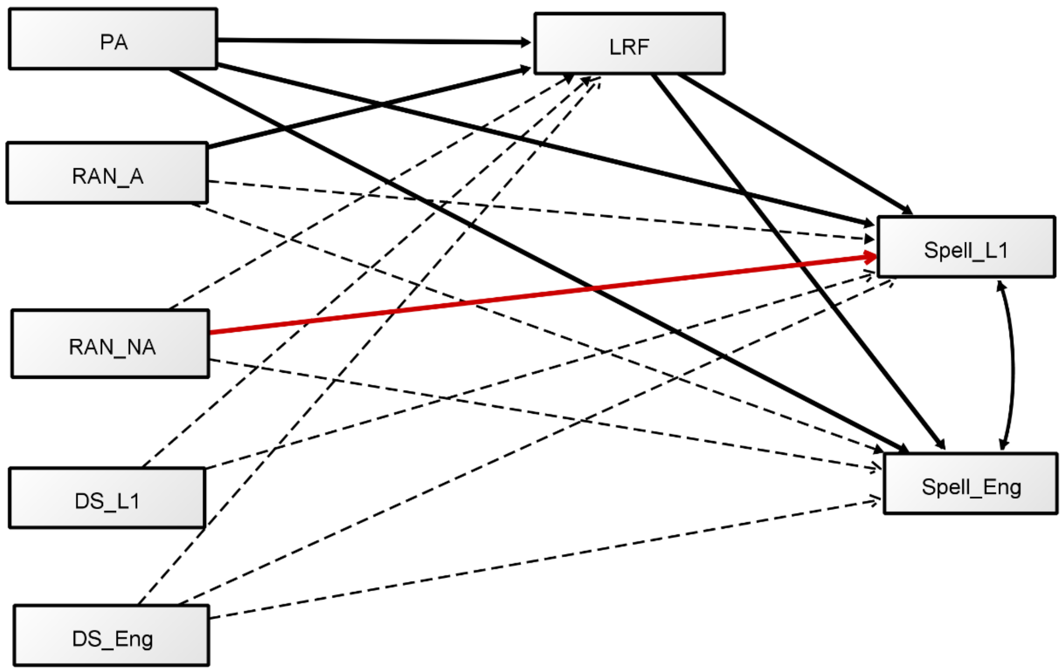


Figure 5-11. Path model fit to the grade 3 sample, predicting L1 and English spelling with LRF as mediator

Notes: scaled χ^2 (19) = 10.326, p = .944, scaling factor = 1.003, robust CFI = 1.0, robust TLI = 1.035, robust RMSEA = 0.0, 90% CI [0.0; 0.019], SRMR = .026. Non-significant paths indicated in dashes. Significant paths indicated in solid black (positive) and red (negative). Not shown are the covariances between the predictor variables (on the left of the figure).

5.3.4.3 *Summary: Path analysis*

The path analysis for reading fluency revealed that the groups differed in their correlation between L1 and English reading fluency, with the isiZulu group (r = .79) having a higher correlation than the isiXhosa group (r = .47). Furthermore, the relations between digit span and literacy differed. L1 digit span was directly related to L1 reading fluency for the isiXhosa group, and this relation was nonsignificant and small for the isiZulu group. English digit span had a significant direct effect on LRF for the isiZulu group, and this effect was nonsignificant in the isiXhosa group. As at t1, both LRF and PA had direct effects on reading fluency, and the effect of RAN was indirect via LRF. The relations for spelling were the same for both groups. LRF and PA had direct effects on L1 and English spelling, and the effect of alphanumeric RAN was indirect via LRF. Only the total effect of L1 digit span was significant on L1 spelling. Non-alphanumeric RAN had a negative (suppressive) effect on L1 spelling only.

5.4 CONCLUSION

This chapter reported the results at t2 and followed the same analytic plan as at t1. The descriptive statistics analysis revealed that a sizable proportion of the sample were still non-readers. Specifically, approximately 50% scored zero for the L1 word reading task and 70% scored zero for the English word reading tasks. The groups had similar scores on all tasks except for the following. Scores were better for the isiZulu group for L1 NWR, English digit span, English RAN colours, English RAN Objects and English sight word reading fluency. Scores were higher for the isiXhosa group for letter recognition accuracy and fluency, L1 word reading accuracy and fluency, L1 spelling.

The correlations between tasks revealed moderate to strong correlations between PA and literacy moderate correlations between RAN and literacy, and weak to moderate correlations between PWM and literacy. Some correlations (such as within literacy and PA task correlations) were stronger for the isiZulu than the isiXhosa group. English RAN objects and the digit span tasks revealed different patterns in the isiXhosa and isiZulu groups. English RAN objects was weakly correlated with literacy within English, and across to L1 for the isiXhosa but not the isiZulu group. For the isiXhosa group, the digit span - literacy correlation was moderate to strong ($r = .30 – .60$) for L1 digit span and weak ($r < .35$) for English digit span. For the isiZulu group, English digit span was moderately to strongly correlated ($r = .40 - .60$), and L1 digit span was weakly correlated ($r < .40$).

The CFA analysis revealed that a language general model fit the PA data better than a language specific model. A language general task general PWM model fit the data better than a language general task specific model. Given low loadings of NWR, only digit span was used in the path analysis. A language and task general RAN model fit the data was well as a language general task specific model. Given that alphanumeric and non-alphanumeric RAN tasks have slightly different correlations with literacy, the language general, task specific model was used in the path analysis.

The path analyses revealed that the predictors of spelling were the same for both groups, but that there were some differences in the predictors of reading fluency in each group. What was common for both outcomes is that LRF and PA had direct effects on reading and spelling, and the effect of alphanumeric RAN was via LRF. The reading fluency model differed in the effect of digit span. L1 digit span was a significant direct predictor of L1 reading fluency for the isiXhosa group, and English digit span was a significant direct predictor of LRF. In the spelling model, English digit span had a significant total effect on L1 spelling. Thus, with the exception of the involvement of digit span, the pattern of predictors was the same for t1 and t2 literacy outcomes.

6 Chapter 6. Longitudinal trajectories of and relationships between cognitive-linguistic and literacy skills from grade 1 to grade 3

6.1 INTRODUCTION

This chapter begins with a summary of the data collection method followed at the end of grade 3 (t3). The descriptive statistics and the correlations for variables measured at t3 are presented to provide an overview of the final level of attainment of literacy skills. The next analysis addresses to what extent the scores on the various tasks improved over time. The developmental trajectories of the phonological processing skills and spelling skills across two time points (end of grade 1 (t1) and start of grade 3 (t2)), and the developmental trajectories of reading fluency at three time points (t1, t2, and t3) are presented. This analysis addresses how attainment in skills changed over time. Finally, path analyses were fit to the data to examine how phonological processing, letter knowledge and vocabulary knowledge are related to literacy longitudinally. The analysis includes five path models with t1 predictors of t2 reading, t2 spelling, t3 reading, t3 spelling, and t3 reading comprehension and three path models with t2 predictors of t3 reading, t3 spelling, and t3 reading comprehension.

6.2 METHOD

Detailed information about the participants, research instruments and procedures is presented in chapter 3 and summarised below. At t3, testing took place twice, both individually and in a group format (see section 6.2.3, below).

6.2.1 Participants

The individual tests of L1 and English oral reading were completed by 121 participants, which was one participant fewer than at t2. This participant was from the isiZulu sample and was ill during the testing dates. The spelling and written comprehension group assessments in L1 and English were completed by 119 participants. Two participants were absent on the day of these assessments at the isiXhosa school due to illness. Thus, the final t3 sample of 121 participants included 55 (45.5%) boys and 66 (55.5%) girls.

6.2.2 Instruments

At t3, only literacy tasks were administered due to time constraints[30]. T3 was also the first time that reading comprehension was measured, following the oral reading fluency task, and in a written comprehension test. Spelling from dictation was also administered including 10 words in L1 and 10 words in English. Chapter 3 discusses

[30] These reasons are addressed in section 3.8.1 of Chapter 3. In short, teachers were pressured to complete the curriculum, so only the minimum number of measures were administered to reduce disruptions in teaching.

the instruments used at t3 in more detail, including their inter-rater reliability and internal consistency estimates.

6.2.3 Data collection procedure

Participants were assessed at the start of term 4 of 2021 (t3). Participants completed the individual literacy tasks for L1 and English in one session, followed by a group administered test which included both languages in a second session. Rotational timetabling was still in effect at all three schools, so I did my best to conduct the individual and group tests on the same day. However, this was not always possible due to timetable changes in each school.

6.2.4 Data analysis procedure

The t3 data was examined descriptively by providing the mean and standard deviation for each task, among other statistics. Pearson's correlation was used to examine bivariate zero-order correlations between the t3 variables. The developmental trajectories were explored using hierarchical linear models which included coefficient for time, language, and a time by language interaction, while nesting the data within participants. This allowed me to examine how task scores changed over time, whether the language groups differed at t1 in the intercept, and whether the rate of change differed by language group. Multi-group path analysis models were fit to the data to examine t1 phonological processing, t1 letter sound recognition fluency and t1 vocabulary knowledge on t2 and t3 literacy outcomes (models 1 – 5). Multi-group path analysis models were fit to the data to examine t2 phonological processing and t2 letter sound recognition fluency on t3 literacy outcomes (models 6 – 8). The model fit indices were inspected to determine whether the models were a good fit to the data. The results are presented in text, in tables, and in relevant figures.

6.3 RESULTS

6.3.1 Descriptive statistics of and correlations between literacy measures at t3

6.3.1.1 Descriptive statistics of t3 measures

The descriptive statistics per language group and for the whole sample are presented in *Table 6-1* and *Table 6-2*, respectively[31], and visualised in *Figure 6-1*. Fluency scores,

[31] Usually, descriptive statistics for the whole group are presented before descriptive statistics for sub-samples. I have chosen to present and interpret the results for the sub-samples as my study aims to determine whether the longitudinal development and relations between phonological processing and literacy are the same for two groups of participants who speak and are learning to read two closely related languages. I provide the statistics for the whole sample for completeness, and for use by other researchers who may want to use these results in meta-analyses or syntheses.

in correct letters or words per minute, are presented for timed tasks in *Table 6-1* and *Figure 6-1*. Accuracy is also included in the table and figure as a proportion ranging from 0 to 1. A proportion is the same as a percentage but divided by 100. For example, a proportion of 0.8 for the isiZulu group mean for letter recognition accuracy is the same as 80% accuracy. I also present the total number of words read correctly for the L1 word reading task, and the three English word reading tasks because these tasks do not necessarily need to be timed. In effect, the number of words read correctly is an unstandardised version of the accuracy proportions mentioned earlier, i.e., 15 words read correctly out of 20 words attempted in the L1 task corresponds to 75% accuracy.

Cohen's d effect size was used to compare the mean performance of each group, with 95% confidence intervals overlapping zero indicating that the mean difference between the groups is small, and likely not practically significant. Welch's t-test results with uncorrected p values and corrected p values (q) for the false discovery rate are presented in text for standardised group differences which did not overlap with zero.

Table 6-1 shows that the groups differed on five tasks at t3, so I calculated the Welch's t-test statistics and p values corrected for multiple comparisons for these five tasks. The isiXhosa group had higher average scores on letter recognition accuracy (Xhosa M = 90%, SD = 10%, Zulu M = 80%, SD = 20%, $t(92.4) = 2.73$, $p = .008$, $q = .017$, $d = 0.5$, 95%CI = [0.1; 0.9]), LRF (Xhosa M = 52.8 clpm, SD = 26, Zulu M = 40.9 clpm, SD = 26.7, $t(118.3) = 2.47$, $p = .015$, $q = .017$, $d = 0.5$, 95%CI = [0.1; 0.8]), L1 word reading accuracy (Xhosa M = 70%, SD = 40, Zulu M = 60%, SD = 40, $t(114.4) = 2.36$, $p = .012$, q = .017, $d = 0.5$, 95%CI = [0.1; 0.8]), L1 word reading fluency (Xhosa M = 27.1 cwpm, SD = 20.5, Zulu M = 17.9 cwpm SD = 19.6, $t(119) = 2.51$, $p = .013$, $q = .017$, $d = 0.5$, 95%CI = [0.1; 0.8]), and L1 spelling (Xhosa M = 6.4, SD = 3.8, Zulu M = 4.1, SD = 3.9, $t(116.8) = 3.28$, $p = .001$, $q = .009$, $d = 0.6$, 95%CI = [0.2; 1.0]). Using the benchmarks by Plonsky and Oswald (2014), these effects can be considered small to medium in size. All other effect sizes overlapped with zero.

Table 6-1. Distribution of scores by language group at the end of grade 3 (t3) including Cohen's d effect size

	isiXhosa							isiZulu							Effect size	
Task (unit/maximum score)	**n***	**Mdn**	**M**	**SD**	**Min**	**Max**	**% Zero**	**n**	**Mdn**	**M**	**SD**	**Min**	**Max**	**% Zero**	**d**	**95% CI**
First Language (L1)																
LR Accuracy (prop.)	62	1	0.9	0.1	0.5	1	0	59	0.9	0.8	0.2	0	1	1.7	**0.5**	**[0.1; 0.9]**
LR Fluency (clpm)	62	59	52.8	26	6	110	0	59	40	40.9	26.7	0	95	1.7	**0.5**	**[0.1; 0.8]**
RWR (correct words)	62	19	14.7	7.4	0	20	9.7	59	15	11.3	8.6	0	20	32.2	**0.4**	**[0.1; 0.8]**
RWR Accuracy (prop.)	62	0.9	0.7	0.4	0	1	9.7	59	0.8	0.6	0.4	0	1	32.2	**0.5**	**[0.1; 0.8]**
RWR Fluency (cwpm)	62	26.2	27.1	20.5	0	80	9.7	59	11.5	17.9	19.6	0	75.7	32.2	**0.5**	**[0.1; 0.8]**
TR Accuracy (prop.)	62	0.9	0.7	0.4	0	1	21	59	0.8	0.5	0.5	0	1	37.3	0.4	[0.0; 0.7]
TR Fluency (cwpm)	62	17.5	19.8	16.2	0	62.3	21	59	11	13.5	14.5	0	50	37.3	0.4	[0.0; 0.8]
RC Oral (prop.)	62	0.4	0.5	0.3	0	1	25.8	59	0	0.3	0.4	0	1	50.8	0.3	[0.0; 0.7]
RC Written (prop.)	60	0.5	0.4	0.3	0	1	23.3	59	0.2	0.3	0.4	0	1	42.4	0.3	[-0.1; 0.6]
Can spell 'imoto'	60	1	0.8	0.4	0	1	16.7	59	1	0.6	0.5	0	1	40.7	**0.5**	**[0.2; 0.9]**
Can spell 'indlebe'	60	1	0.5	0.5	0	1	46.7	59	0	0.3	0.5	0	1	67.8	0.4	[0.1; 0.8]
Spelling (/10)	60	8	6.4	3.8	0	10	13.3	59	3	4.1	3.9	0	10	30.5	**0.6**	**[0.2; 1.0]**
English																
NWR (correct words)	62	8.5	10.9	9.2	0	29	17.7	59	6	9.2	9.3	0	28	23.7	0.2	[-0.2; 0.5]
NWR Accuracy (prop.)	62	0.4	0.4	0.3	0	1	17.7	59	0.4	0.4	0.3	0	0.9	23.7	0.1	[-0.3; 0.4]
NWR Fluency (cwpm)	62	5.1	7.5	7.8	0	37.3	17.7	59	5.2	6.8	6.5	0	24.7	23.7	0.1	[-0.3; 0.5]
RWR (correct words)	62	7	10.6	9.8	0	28	25.8	59	8	10.9	10.5	0	29	22	0.0	[-0.4; 0.3]
RWR Accuracy (prop.)	62	0.4	0.4	0.3	0	0.9	25.8	59	0.4	0.4	0.3	0	1	22	-0.1	[-0.5; 0.3]
RWR Fluency (cwpm)	62	6.2	9	10.1	0	37.3	25.8	59	5.3	10	11.5	0	51.2	22	-0.1	[-0.5; 0.3]
SWR (correct words)	62	8	9.5	8.5	0	28	25.8	59	7	10	9.7	0	29	22	-0.1	[-0.4; 0.3]
SWR Accuracy (prop.)	62	0.4	0.4	0.3	0	0.9	25.8	59	0.4	0.4	0.3	0	1	22	-0.1	[-0.5; 0.2]
SWR Fluency (cwpm)	62	8.2	8.5	8.8	0	44.2	25.8	59	6.6	10.4	11.8	0	49.7	22	-0.2	[-0.5; 0.2]
TR Accuracy (prop.)	62	0.7	0.5	0.4	0	1	30.6	59	0.7	0.5	0.4	0	1	30.5	0.0	[-0.4; 0.3]
TR Fluency (cwpm)	62	17.5	22.6	25.5	0	95	30.6	59	12	23.7	27.1	0	92	30.5	0.0	[-0.4; 0.3]
RC Oral (prop.)	62	0	0.1	0.2	0	0.8	69.4	59	0	0.2	0.3	0	1	64.4	-0.4	[-0.8; 0.0]
RC Written (prop.)	60	0	0.2	0.3	0	1	51.7	59	0	0.3	0.3	0	1	54.2	-0.2	[-0.6; 0.1]
Spelling (/10)	60	1	1.6	1.8	0	8	33.3	59	1	1.9	2.4	0	8	40.7	-0.2	[-0.5; 0.2]

Notes: *Two participants in the isiXhosa group did not complete the written test due to illness. Prop: proportion, multiply by 100 to get a percentage; LR: letter recognition; RWR: regular word reading; TR: text reading; RC: reading comprehension; NWR: nonword reading; SWR: sight word reading.

Table 6-2. Distribution of scores at the end of grade 3 (t3) for the entire sample

Task (unit/maximum score)	**N***	**Mdn**	**M**	**SD**	**Min**	**Max**	**% Zero**
First Language (L1)							
LR Accuracy (prop.)	121	0.9	0.9	0.2	0	1	0.8
LR Fluency (clpm)	121	52	47	26.9	0	110	0.8
RWR (correct words)	121	17	13	8.2	0	20	20.7
RWR Accuracy (prop.)	121	0.8	0.7	0.4	0	1	20.7
RWR Fluency (cwpm)	121	18.4	22.6	20.5	0	80	20.7
TR Accuracy (prop.)	121	0.9	0.6	0.4	0	1	28.9
TR Fluency (cwpm)	121	15	16.7	15.7	0	62.3	28.9
RC Oral (prop.)	121	0.4	0.4	0.4	0	1	38.0
RC Written (prop.)	119	0.3	0.4	0.3	0	1	32.8
Can spell 'imoto'	119	1	0.7	0.5	0	1	28.6
Can spell 'indlebe'	119	0	0.4	0.5	0	1	57.1
Spelling (/10)	119	6	5.3	4	0	10	21.8
English							
NWR (correct words)	121	7	10.1	9.3	0	29	20.7
NWR Accuracy (prop.)	121	0.4	0.4	0.3	0	1	20.7
NWR Fluency (cwpm)	121	5.1	7.2	7.2	0	37.3	20.7
RWR (correct words)	121	7	10.8	10.1	0	29	24.0
RWR Accuracy (prop.)	121	0.4	0.4	0.3	0	1	24.0
RWR Fluency (cwpm)	121	5.9	9.5	10.8	0	51.2	24.0
SWR (correct words)	121	8	9.7	9.1	0	29	24.0
SWR Accuracy (prop.)	121	0.4	0.4	0.3	0	1	24.0
SWR Fluency (cwpm)	121	7	9.4	10.4	0	49.7	24.0
TR Accuracy (prop.)	121	0.7	0.5	0.4	0	1	30.6
TR Fluency (cwpm)	121	15	23.1	26.2	0	95	30.6
RC Oral (prop.)	121	0	0.1	0.3	0	1	66.9
RC Written (prop.)	119	0	0.2	0.3	0	1	52.9
Spelling (/10)	119	1	1.8	2.1	0	8	37.0

Notes: *Two participants in the isiXhosa group did not complete the written test due to illness. Prop: proportion, multiply by 100 to get a percentage; LR: letter recognition; RWR: regular word reading; TR: text reading; RC: reading comprehension; NWR: nonword reading; SWR: sight word reading.

Figure 6-1 visualises these group differences. This figure includes density plots and rug plots which both show the distribution of the fluency and accuracy data per language group. Peaks in density plots show where a large proportion of the data lies. The rug portion of the graphs (the individual lines beneath the density plots) represent individual data points. The distribution of scores for LRF, L1 word reading fluency, L1 letter recognition accuracy and L1 word reading accuracy are more clustered around zero for the isiZulu compared to the isiXhosa group. The plots for the English tasks look quite similar for the two groups, except that the data points for the isiZulu group is slightly more spread out and further from zero.

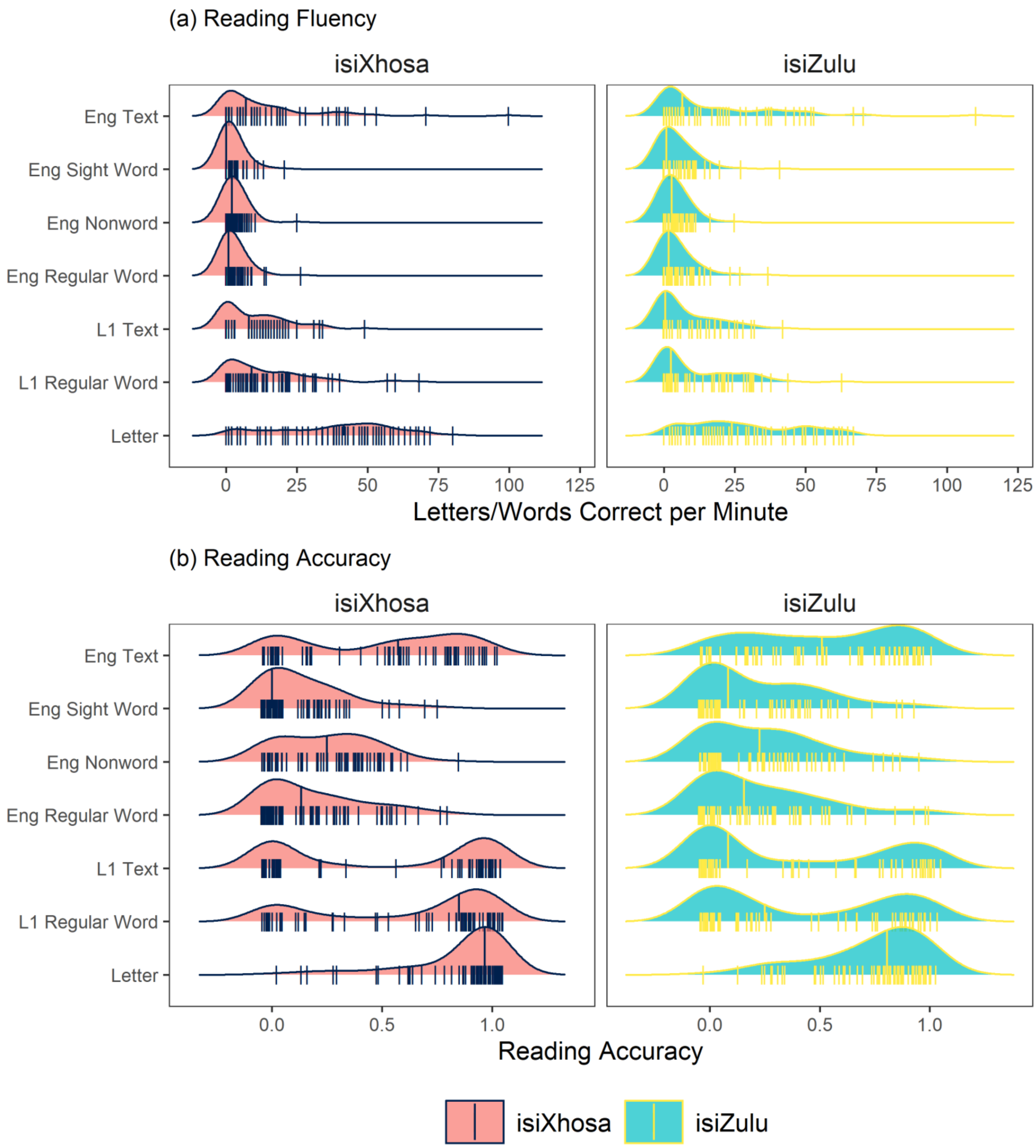


Figure 6-1. Distribution of reading fluency and reading accuracy for each indicator variable, language group, and task language at the end of grade 3 (t3)

The oral reading fluency scores were compared to the reading benchmarks for Nguni languages (35 cwpm by end of grade 3) (Ardington et al., 2020a), and English First Additional Language (50 cwpm by end of grade 3) (Wills, Ardington, Pretorius, et al., 2022). The grade 1 letter reading fluency benchmark of 20 clpm (Ardington et al., 2020a) was met by 71% of the isiXhosa group, and 53% of the isiZulu group. The number of children who met or exceeded the grade 3 oral reading fluency benchmarks was low: 10 isiXhosa and 6 isiZulu children met the L1 grade 3 benchmark, and 10 isiXhosa and 14 isiZulu children met the English grade 3 benchmark. There were still many children scoring zero on these tasks, accounting for approximately 21% of the isiXhosa group and 37% of the isiZulu group for L1 ORF, and 31% of the isiZulu group for English ORF. Thus, the final attainment of reading fluency by the end of grade 3 was variable, but overall, quite low with 40% of the sample not even meeting the grade 1 benchmark for LRF. Reading comprehension scores were also very low: a quarter of isiXhosa and half of the isiZulu children scored zero on the L1 reading comprehension questions asked after the oral fluency task. The reading comprehension scores were especially low in English. About 70% scored zero on the oral version and 50% scored zero on the written version.

6.3.1.2 Zero-order correlations between t3 measures

The within-language correlations for L1 and English are presented in *Table 6-3* and *Table 6-4*, respectively. The tables include correlations between reading fluency and accuracy measures. As has been found in other studies, the within language correlations for literacy in L1 were strong. Pearson's r was above .7 for reading fluency tasks, with almost a perfect correlation between word and text reading fluency (r = .92 isiXhosa; r = .96 isiZulu). Reading comprehension had strong correlations with the reading fluency tasks (r > .70). Spelling was also strongly correlated with the reading tasks (.69 or above). Within English, the reading fluency tasks also correlated strongly (r above .7) with one another, although the correlations were slightly higher in the isiZulu group. For example, the regular word reading fluency and text reading fluency tasks in English correlated at .80 in isiXhosa and correlated almost perfectly in isiZulu at .94. The correlation between reading comprehension and word/text reading was also stronger in the isiZulu group (r between .62 and .77, with most above .7) than the isiXhosa group (r between .46 and .70 with most below .70). Spelling was moderately to strongly correlated with the reading tasks (r between .60 and .83). To summarise, the within L1 correlations were mostly all strong and similar for the isiXhosa and isiZulu groups. In English, the correlations were slightly weaker than in L1 (although still strong for the reading fluency tasks), and overall, these English correlations were stronger in the isiZulu than the isiXhosa group.

Table 6-3. Pearson correlations between L1 variables for the isiXhosa (below diagonal) and isiZulu (above diagonal) groups at the end of grade 3

	Variable	1	2	3	4	5	6	7	8	9	10	11
1	**LRF**	-	0.78***	0.82***	0.85***	0.85***	0.83***	0.40**	0.71***	0.79***	0.77***	0.79***
2	**Letter Recognition Accuracy**	0.81***	-	0.75***	0.61***	0.62***	0.71***	0.55***	0.53***	0.59***	0.59***	0.69***
3	**Regular Word Accuracy**	0.83***	0.91***	-	0.80***	0.82***	0.95***	0.53***	0.66***	0.76***	0.65***	0.80***
4	**Regular Word Fluency**	0.80***	0.66***	0.76***	-	0.96***	0.80***	0.38**	0.83***	0.83***	0.83***	0.87***
5	**Text Fluency**	0.71***	0.62***	0.72***	0.92***	-	0.84***	0.39**	0.83***	0.84***	0.81***	0.89***
6	**Text Accuracy**	0.82***	0.89***	0.94***	0.75***	0.75***	-	0.45***	0.65***	0.80***	0.70***	0.81***
7	**Can spell 'imoto'**	0.57***	0.63***	0.66***	0.51***	0.50***	0.62***	-	0.35**	0.34**	0.35**	0.59***
8	**Can spell 'indlebe'**	0.55***	0.50***	0.62***	0.58***	0.59***	0.60***	0.48***	-	0.73***	0.78***	0.83***
9	**Reading Comprehension (Oral)**	0.66***	0.68***	0.77***	0.72***	0.77***	0.81***	0.57***	0.45***	-	0.81***	0.81***
10	**Reading Comprehension (Written)**	0.68***	0.65***	0.72***	0.74***	0.74***	0.76***	0.50***	0.63***	0.73***	-	0.86***
11	**Spelling**	0.79***	0.80***	0.89***	0.79***	0.75***	0.86***	0.62***	0.81***	0.73***	0.79***	

Table 6-4. Pearson correlations between English variables for the isiXhosa (below diagonal) and isiZulu (above diagonal) groups at the end of grade 3

	Variable	1	2	3	4	5	6	7	8	9	10	11
1	**Regular Word Accuracy**	-	0.83***	0.93***	0.88***	0.91***	0.75***	0.85***	0.89***	0.68***	0.66***	0.76***
2	**Regular Word Fluency**	0.86***	-	0.78***	0.93***	0.80***	0.96***	0.94***	0.73***	0.74***	0.69***	0.80***
3	**Nonword Accuracy**	0.86***	0.75***	-	0.89***	0.88***	0.72***	0.81***	0.85***	0.67***	0.66***	0.71***
4	**Nonword Fluency**	0.78***	0.88***	0.83***	-	0.85***	0.89***	0.91***	0.80***	0.76***	0.70***	0.73***
5	**Sight Word Accuracy**	0.91***	0.77***	0.85***	0.75***	-	0.81***	0.84***	0.86***	0.67***	0.65***	0.72***
6	**Sight Word Fluency**	0.82***	0.89***	0.76***	0.89***	0.83***	-	0.91***	0.70***	0.77***	0.66***	0.73***
7	**Text Fluency**	0.83***	0.80***	0.73***	0.74***	0.78***	0.79***	-	0.81***	0.77***	0.77***	0.83***
8	**Text Accuracy**	0.86***	0.71***	0.77***	0.66***	0.89***	0.73***	0.81***	-	0.63***	0.62***	0.69***
9	**Reading Comprehension (Oral)**	0.56***	0.50***	0.46***	0.45***	0.51***	0.49***	0.70***	0.53***	-	0.73***	0.63***
10	**Reading Comprehension (Written)**	0.65***	0.64***	0.63***	0.69***	0.63***	0.64***	0.68***	0.56***	0.63***	-	0.75***
11	**Spelling**	0.67***	0.58***	0.69***	0.60***	0.65***	0.59***	0.78***	0.59***	0.60***	0.65***	-

The cross-language correlations are presented in *Table 6-5* and *Table 6-6* for the isiXhosa and isiZulu groups, respectively. The cross-language correlations differed somewhat by language group. In the isiZulu group, the cross-language correlations were mostly strong (most between .6 and .8), and the same tasks correlated very strongly (regular word reading: r = .93; text fluency: r = .94, spelling: r = .80, written reading comprehension: r = .80). In the isiXhosa group, while text reading fluency had a very high correlation (r = .9) most of the cross-language correlations were below .8, with most correlations occurring between .5 and .7. The same tasks in each language correlated moderately (regular word reading: r = .68; spelling: r = .66, written reading comprehension: r = .64). In summary, there were significant cross-language correlations which were especially high between the same tasks, and the cross-language correlations were generally stronger for the isiZulu group.

Table 6-5. Cross-language Pearson correlations between variables for the isiXhosa group at the end of grade 3

L1	**LR Fluency**	**LR Accuracy**	**Reg Word Accuracy**	**Reg Word Fluency**	**Text Fluency**	**Text Accuracy**	**Can spell 'imoto'**	**Can spell 'indlebe'**	**RC (Oral)**	**RC (Written)**	**Spelling**
English											
Regular Word Accuracy	0.70***	0.59***	0.72***	0.82***	0.85***	0.72***	0.52***	0.60***	0.80***	0.74***	0.78***
Regular Word Fluency	0.51***	0.41***	0.53***	0.68***	0.74***	0.54***	0.38**	0.41**	0.62***	0.64***	0.56***
Nonword Accuracy	0.71***	0.69***	0.79***	0.78***	0.79***	0.79***	0.57***	0.57***	0.86***	0.79***	0.80***
Nonword Fluency	0.44***	0.44***	0.55***	0.61***	0.68***	0.55***	0.39**	0.43***	0.68***	0.66***	0.59***
Sight Word Accuracy	0.75***	0.66***	0.79***	0.82***	0.84***	0.81***	0.62***	0.65***	0.81***	0.77***	0.80***
Sight Word Fluency	0.49***	0.42***	0.58***	0.69***	0.75***	0.59***	0.43***	0.54***	0.66***	0.68***	0.60***
Text Fluency	0.56***	0.44***	0.56***	0.85***	0.90***	0.57***	0.38**	0.46***	0.67***	0.66***	0.59***
Text Accuracy	0.75***	0.65***	0.75***	0.80***	0.84***	0.78***	0.53***	0.52***	0.80***	0.72***	0.73***
Reading Comprehension (Oral)	0.39**	0.32*	0.35**	0.62***	0.65***	0.37**	0.25	0.30*	0.45***	0.45***	0.37**
Reading Comprehension (Written)	0.41***	0.43***	0.46***	0.56***	0.66***	0.51***	0.26*	0.41**	0.54***	0.64***	0.50***
Spelling	0.49***	0.48***	0.54***	0.72***	0.78***	0.55***	0.36**	0.57***	0.56***	0.66***	0.66***

Notes: LR: letter recognition; Reg: regular; RC: reading comprehension.

Table 6-6. Cross-language Pearson correlations between variables for the isiZulu group at the end of grade 3

L1	**LR Fluency**	**LR Accuracy**	**Reg Word Accuracy**	**Reg Word Fluency**	**Text Fluency**	**Text Accuracy**	**Can spell 'imoto'**	**Can spell 'indlebe'**	**RC (Oral)**	**RC (Written)**	**Spelling**
English											
Regular Word Accuracy	0.81***	0.74***	0.86***	0.87***	0.88***	0.84***	0.53***	0.75***	0.81***	0.72***	0.88***
Regular Word Fluency	0.77***	0.56***	0.69***	0.93***	0.90***	0.70***	0.34**	0.72***	0.75***	0.74***	0.81***
Nonword Accuracy	0.75***	0.75***	0.84***	0.82***	0.83***	0.80***	0.63***	0.70***	0.74***	0.70***	0.86***
Nonword Fluency	0.77***	0.63***	0.77***	0.89***	0.87***	0.74***	0.46***	0.72***	0.71***	0.71***	0.83***
Sight Word Accuracy	0.79***	0.74***	0.81***	0.82***	0.84***	0.80***	0.52***	0.68***	0.76***	0.69***	0.84***
Sight Word Fluency	0.76***	0.55***	0.65***	0.86***	0.84***	0.66***	0.32*	0.64***	0.71***	0.70***	0.75***
Text Fluency	0.80***	0.60***	0.75***	0.94***	0.94***	0.75***	0.39**	0.80***	0.75***	0.78***	0.87***
Text Accuracy	0.82***	0.76***	0.91***	0.80***	0.82***	0.89***	0.54***	0.68***	0.76***	0.68***	0.85***
Reading Comprehension (Oral)	0.58***	0.44***	0.56***	0.71***	0.69***	0.55***	0.37**	0.61***	0.62***	0.65***	0.70***
Reading Comprehension (Written)	0.60***	0.55***	0.54***	0.72***	0.69***	0.55***	0.42**	0.69***	0.61***	0.81***	0.80***
Spelling	0.62***	0.54***	0.65***	0.83***	0.80***	0.64***	0.40**	0.73***	0.69***	0.70***	0.80***

Notes: LR: letter recognition; Reg: regular; RC: reading comprehension.

6.3.1.3 Summary of t3 outcomes

In summary, the final literacy attainment of participants was low, with 10%-30% not being able to read one word correctly. Nevertheless, some participants had met the grade 3 benchmark for L1 and English reading. As has been found in other research using EGRA, the tasks were moderately to strongly associated within and across language. These associations were slightly stronger in the isiZulu group.

6.3.2 Developmental trajectories of phonological processing and literacy skills

Multilevel models, also called mixed effect models, were fit to the data to examine the longitudinal trajectories of phonological processing and literacy skills. The models were fit with *lmer* in *lmerTest* (Kuznetsova et al., 2017), using restricted maximum likelihood estimation and the Kenward-Roger correction (McNeish, 2017). Fixed effects were included for timepoint, language group and the interaction by timepoint and language group. Timepoint was treated as continuous by centring at the first assessment point (zero), and the number of terms that passed as reflected for t2 (6 terms) and t3 (8 terms). Language was treatment coded such that isiXhosa was 1 and isiZulu was 0. Random effects included a varying intercept by subject. The model took the form in equation 1 below and was fit to each assessed variable.

(1) *variable score* ~ 1 + time + language + time*language + (1 | id)

Raw scores for the variables were used, except for RAN naming time which was transformed to an items per second score to improve the distribution of model residuals. The transformed RAN scores were also multiplied by -1 to preserve the interpretation that smaller numbers are better. The plots of model residuals revealed no major deviations from normality or homoscedasticity. The p values associated with fixed effects were provided via *lmerTest*.

The main focus of this analysis was on the fixed effects of time, language, and the time by language interaction. The coefficients are interpreted the same way as linear models. The random effects results are also provided. These include the random intercept variance (τ^2), which is the variability in the population between individuals (clusters), the residual variance ($\sigma2$) which is the variability in the population within individuals (clusters), and the intra-class correlation (ICC) (Finch et al., 2019). ICC (which ranges from 0 to 1) is the proportion of variance of the outcome variable that is explained by the cluster variable (in this case, the individual participants) (Lorah, 2018). A low ICC indicates that there is no variance between clusters, and a high ICC indicates variance between rather than within clusters (Finch et al., 2019). Another way to consider ICC is that it is a measure of the correlation between two data points from the same participant. Thus, a larger ICC indicates more longitudinal stability in scores on the task.

This analysis could also have been conducted using repeated measures ANOVA models. However, mixed models were selected because they allow for the time variable to be continuous rather than categorical, and therefore, can account for measurement points which are not evenly spaced in time (Steyn, 2021). Furthermore, mixed models better handle missing data (Steyn, 2021). For the present study, mixed models were also selected because they are interpreted similarly to linear regression models.

6.3.2.1 Developmental trajectories of phonological processing skills

The developmental trajectories of each task measuring PA, RAN and PWM were examined from t1 (term 3 of grade 1) to t2 (start of grade 3), i.e., six school terms later. The Bonferroni correction method was applied within constructs to correct for multiple comparisons: the alpha level of .05 was divided by the number of models per construct. A fixed effect was considered statistically significant if the p value was below this corrected p value level.

All PA skills, except for English blending improved over time, and there were no language or time by language interaction effects i.e., the groups improved on these skills similarly over time (*Table 6-7*, *Figure 6-2*). English blending ($\beta = 0.300$, $p = .010$) was significant at the alpha level of .05, but the p value was larger than the Bonferroni corrected alpha level of .008. The ICC was similar for all tasks (between .40 and .50) except for isolation which was much higher (.74). Thus, the PA scores were more correlated over time for English isolation, than for the other tasks.

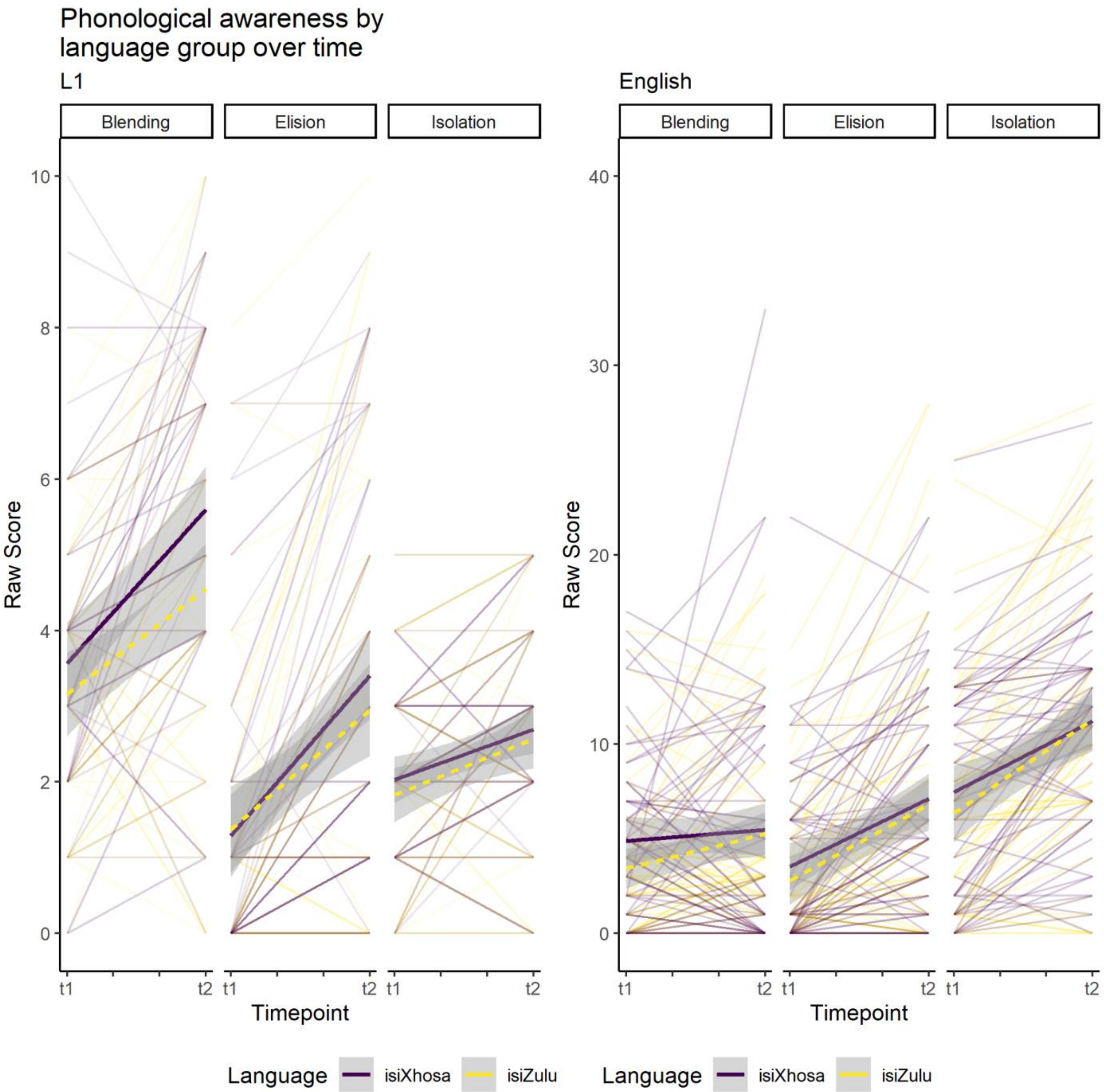


Figure 6-2. Developmental trajectory of PA by task language and language group based on raw data

Table 6-7. Output of linear mixed effects models of the trajectory of PA over time and by language group

	L1 Blending			**L1 Elision**			**L1 Isolation**			**Eng Blending**			**Eng Elision**			**Eng Isolation**		
Predictors	*Est.*	*se*	*p*	*Est.*	*se*	*p*	*Est.*	*se*	*p*	*Est.*	*se*	*p*	*Est.*	*se*	*p*	*Est.*	*se*	*p*
Intercept	3.166	0.277	**<.001**	1.364	0.279	**<.001**	1.832	0.167	**<.001**	3.391	0.598	**<.001**	2.737	0.632	**<.001**	6.351	0.721	**<.001**
Time	0.227	0.053	**<.001**	0.267	0.048	**<.001**	0.116	0.031	**<.001**	0.300	0.116	**.010**	0.685	0.112	**<.001**	0.811	0.095	**<.001**
Language[isiXhosa]	0.399	0.394	.312	-0.074	0.397	.852	0.197	0.238	.407	1.479	0.849	.083	0.785	0.898	0.383	1.069	1.028	.299
Time*Language	0.108	0.074	.147	0.088	0.067	.194	-0.009	0.044	.834	-0.208	0.164	.205	-0.099	0.158	.532	-0.169	0.133	.206
Random Effects																		
σ^2	3.12			2.55			1.10			15.11			14.04			9.65		
τ_{00}	2.27 id			2.94 id			0.87 id			9.96 id			14.00 id			27.05 id		
ICC	0.42			0.54			0.44			0.40			0.50			0.74		
N	140 id			140 id			140 id			140 id			140 id			140 id		
Observations	261			261			261			260			260			258		
Marginal R^2 / Conditional R^2	0.139 / 0.502			0.141 / 0.601			0.058 / 0.473			0.025 / 0.412			0.117 / 0.558			0.118 / 0.768		

Notes: model: *variable* ~ 1 + time + language + time*language + (1 | id).

Marginal R^2 = variance explained by fixed effects; Conditional R^2 = variance explained by entire model. With Bonferroni correction, p values below .008 should be considered statistically significant.

Figure *6-3* presents the development of naming speed over time, and the model results are presented in *Table 6-8*. The alphanumeric tasks showed an overall decrease in naming times (fixed effect of time significant at $p < .001$) with no difference between language groups. However, fewer children were administered the letter naming task since they were not familiar with letters at t1. The slope for RAN digits (β = -0.056, 95% CI [-0.068; -0.045]) was steeper (faster improvement) than that for RAN letters (β = -0.030, 95% CI [-0.048; -0.011]). The speed to name objects in L1 did not change over time (β = -0.010, 95% CI [-0.019; -0.002]). The uncorrected p value was .017 which was more than the Bonferroni corrected p value of .010 and is, therefore, considered non-significant. The time taken to name English non-alphanumeric items also decreased over time (fixed effect of time significant at $p <.001$), but the intercept for the isiXhosa group was higher (slower) at both time points (main effect of language was significant at $p < .001$ (Colours) and $p = .002$ (Objects)). The time by language interaction effect was not significant. The slopes for English colour (β = -0.028, 95% CI [-0.035; -0.021]) and object (β = -0.021, 95% CI [-0.029; -0.014]) naming overlapped with one another indicating a similar trajectory (slope) of development in this sample. The ICC varied by task, being smallest for L1 RAN objects (.38) and highest for English RAN colours (. 71). Thus, two data points for the same participant were moderately to strongly correlated across time for RAN.

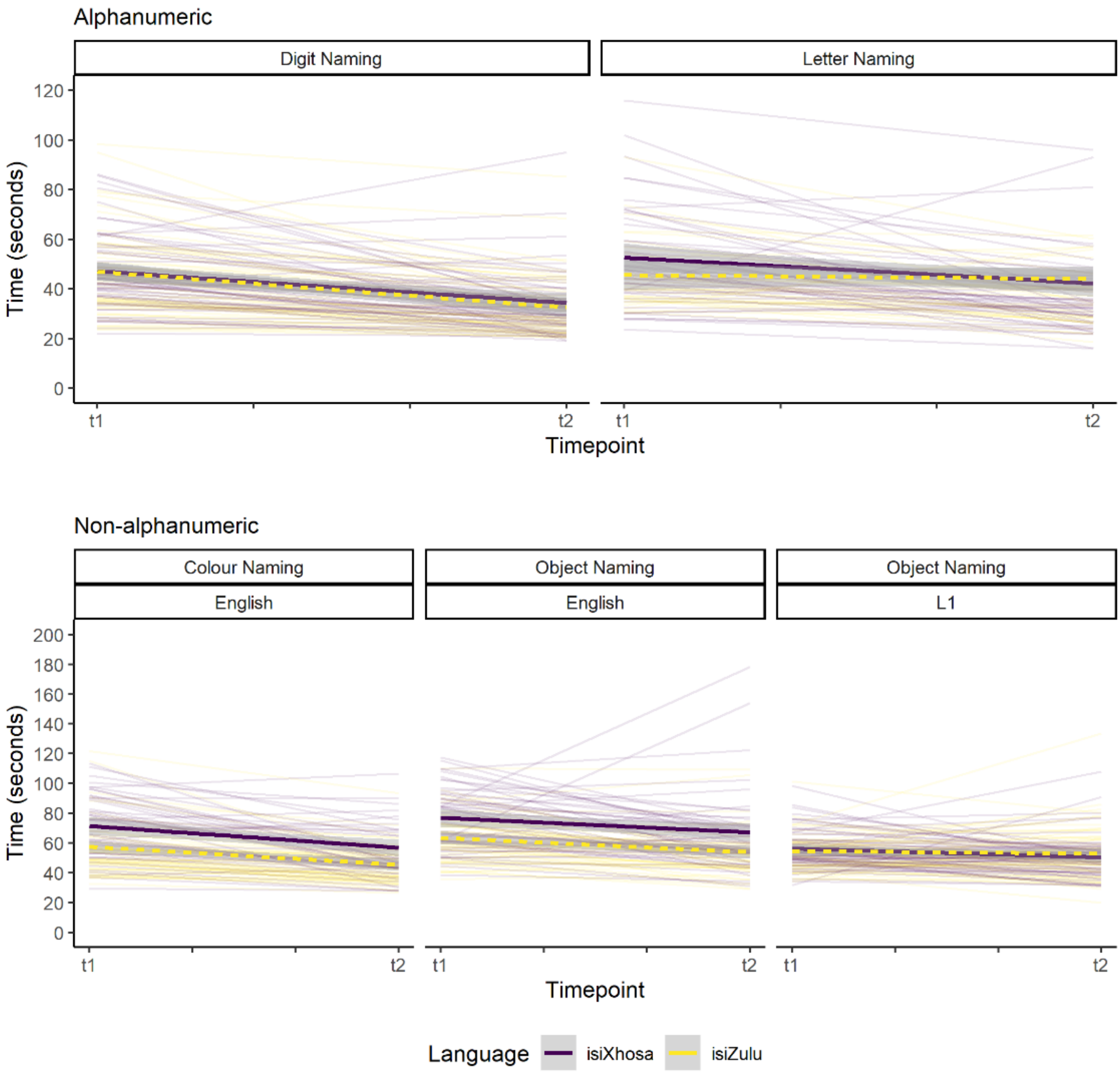


Figure 6-3. Developmental trajectory of RAN by task language and language group based on raw data

Table 6-8. Output of linear mixed effects models of the trajectory of RAN over time and by language group

	Eng RAN Digits			**L1 RAN Letters**			**Eng RAN Colours**			**Eng RAN Objects**			**L1 RAN Objects**		
Predictors	*Est.*	*se*	*p*	*Est.*	*se*	*p*	*Est.*	*se*	*p*	*Est.*	*se*	*p*	*Est.*	*se*	*p*
Intercept	-0.872	0.039	**<.001**	-0.768	0.054	**<.001**	-0.673	0.026	**<.001**	-0.595	0.023	**<.001**	-0.688	0.022	**<.001**
Time	-0.056	0.006	**<.001**	-0.030	0.009	**.001**	-0.028	0.004	**<.001**	-0.021	0.004	**<.001**	-0.010	0.004	.017
Language[isiXhosa]	0.029	0.055	.595	0.033	0.072	.643	0.142	0.038	**<.001**	0.098	0.032	**.002**	0.013	0.031	.676
Time*Language	0.001	0.008	.894	-0.021	0.012	.080	-0.003	0.005	.583	0.005	0.005	.370	-0.004	0.006	.486
Random Effects															
σ^2	0.04			0.06			0.01			0.01			0.02		
τ_{00}	0.07_{id}			0.07_{id}			0.03_{id}			0.02_{id}			0.01_{id}		
ICC	0.66			0.53			0.71			0.53			0.38		
N	139_{id}			125_{id}			134_{id}			137_{id}			140_{id}		
Observations	255			209			236			241			260		
Marginal R^2 / Conditional R^2	0.215 / 0.731			0.116 / 0.580			0.203 / 0.771			0.171 / 0.611			0.041 / 0.406		

Notes: model: *variable* ~ 1 + time + language + time*language + (1 | id).

Marginal R^2 = variance explained by fixed effects; Conditional R^2 = variance explained by entire model; RAN time was transformed into items per second score then multiplied by -1 to improve model fit and the "lower number is better" interpretation. With Bonferroni correction, p values below .010 should be considered statistically significant.

The trajectory of PWM differed by task (*Table 6-9*, *Figure 6-4*). L1 Digit Span did not improve significantly over time (β = 0.111, 95% CI [0.011; 0.212], p = .030), when considering the Bonferroni corrected p value (significant if p <= .0125). On the other hand, the fixed effect of time was significant for English digit span (β = 0.521, 95% CI [0.406; 0.635], p = < .001). The interaction of time by language was also significant (β = -.0333, 95% CI [-0.494; -0.173], p < .001) for English digit span, indicating that the isiXhosa group had a less steep slope over time than the isiZulu group. The fixed effects and their interaction were significant for both L1 and English NWR. In summary, there was an improvement over time on average on both the L1 and English NWR tasks. The isiXhosa group also had a higher intercept for both tasks. The time by language interaction was significant and negative for both tasks, indicating that the isiXhosa group's slope was less steep than the isiZulu group. The ICC was around .35 for all tasks except for English digit span where the ICC was .59. Thus, the correlation within task across time was not very stable, except for English digit span which was moderately stable.

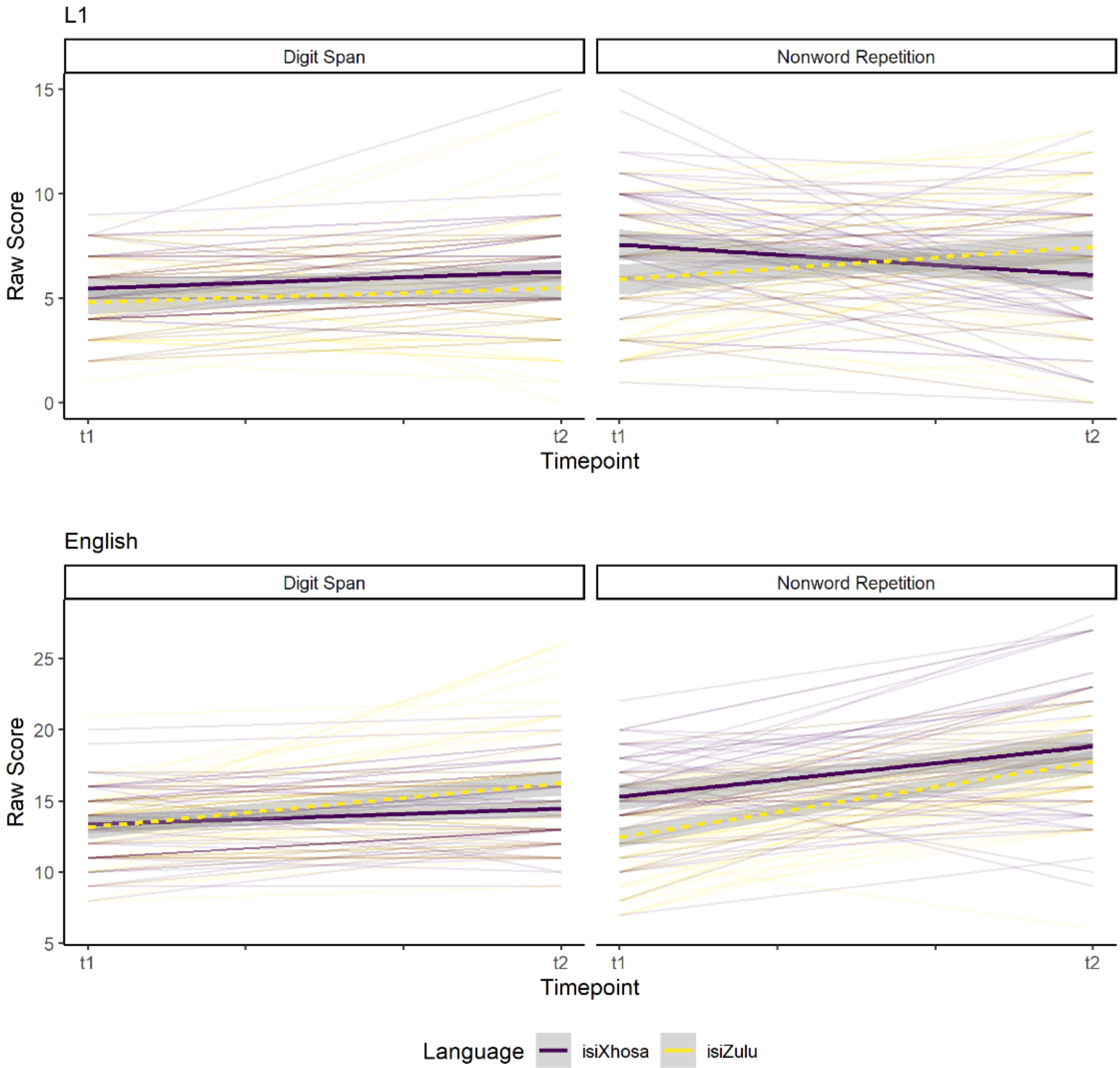


Figure 6-4. Developmental trajectory of PWM by task language and language group based on raw data

Table 6-9. Output of linear mixed effects models of the trajectory of PWM over time and by language group

	L1 Digit Span			L1 NWR			Eng Digit Span			Eng NWR		
Predictors	*Est.*	*se*	*p*	*Est.*	*se*	*p*	*Est.*	*se*	*p*	*Est.*	*se*	*p*
Intercept	4.803	0.262	**<.001**	5.917	0.368	**<.001**	13.166	0.361	**<.001**	12.451	0.414	**<.001**
Time	0.111	0.051	.030	0.256	0.075	**.001**	0.521	0.058	**<.001**	0.887	0.085	**<.001**
Language[isiXhosa]	0.583	0.384	.130	1.649	0.523	**.002**	0.168	0.513	.744	2.872	0.588	**<.001**
Time*Language	0.039	0.074	.593	-0.500	0.106	**<.001**	-0.333	0.082	**<.001**	-0.306	0.119	**.011**
Random Effects												
σ^2	2.94			6.39			3.77			8.06		
τ_{00}	1.88 id			3.12 id			5.40 id			3.82 id		
ICC	0.39			0.33			0.59			0.32		
N	139 id			140 id			140 id			140 id		
Observations	252			261			261			259		
Marginal R^2 / Conditional R^2	0.057 / 0.426			0.057 / 0.366			0.141 / 0.647			0.340 / 0.552		

Notes: model: *variable* ~ 1 + time + language + time*language + (1 | id).

Marginal R^2 = variance explained by fixed effects; Conditional R^2 = variance explained by entire model. With Bonferroni correction, p values below .0125 should be considered statistically significant.

6.3.2.2 *Developmental trajectory of literacy skills*

The developmental trajectories of reading fluency (letter recognition and text reading), and word reading (total words correct) were examined from t1 (term 3 of grade 1) to t3 (term 3 of grade 3), i.e., eight school terms later. The Bonferroni correction method was applied within constructs to correct for multiple comparisons. The alpha level of .05 was divided by the number of models per construct. A fixed effect was considered significant if the p value was below this corrected p value level.

L1 letter recognition, L1 text reading fluency and English text reading fluency improved over time, with similar intercepts for the isiXhosa and isiZulu groups (Table *6-10*, Figure *6-5*). The coefficient for time can be interpreted as the estimated additional letters/words per minute gained per school term. For the L1 tasks, the interaction of time by language was positive and significant, indicating that the slope for the isiXhosa group was steeper than for the isiZulu group, on average. About 50% (L1 ORF) and 58% (LRF, English ORF) of the variance in the scores was due to within-person variability. Thus, reading fluency was moderately stable over time within individuals.

Table 6-10. Output of linear mixed effects models of the trajectory of reading fluency over time and by language group

	LRF			**L1 ORF**			**Eng ORF**		
Predictors	*Est.*	*se*	*p*	*Est.*	*se*	*p*	*Est.*	*se*	*p*
Intercept	12.565	2.372	**<.001**	1.443	1.311	.272	3.486	2.295	.130
Time	3.178	0.281	**<.001**	1.329	0.169	**<.001**	2.477	0.272	**<.001**
Language[isiXhosa]	2.152	3.372	.524	-0.055	1.862	.976	-0.751	3.262	.818
Time*Language	1.254	0.393	**.002**	0.652	0.237	**.006**	-0.219	0.381	.565
Random Effects									
σ^2	167.09			61.29			156.88		
τ_{00}	234.85 id			61.60 id			219.34 id		
ICC	0.58			0.50			0.58		
N	140 id			140 id			140 id		
Observations	382			382			382		
Marginal R^2 / Conditional R^2	0.327 / 0.720			0.229 / 0.615			0.153 / 0.647		

Notes: model: *variable* ~ 1 + time + language + time*language + (1 | id)

Marginal R^2 = variance explained by fixed effects; Conditional R^2 = variance explained by entire model. With Bonferroni correction, p values below .0167 should be considered statistically significant.

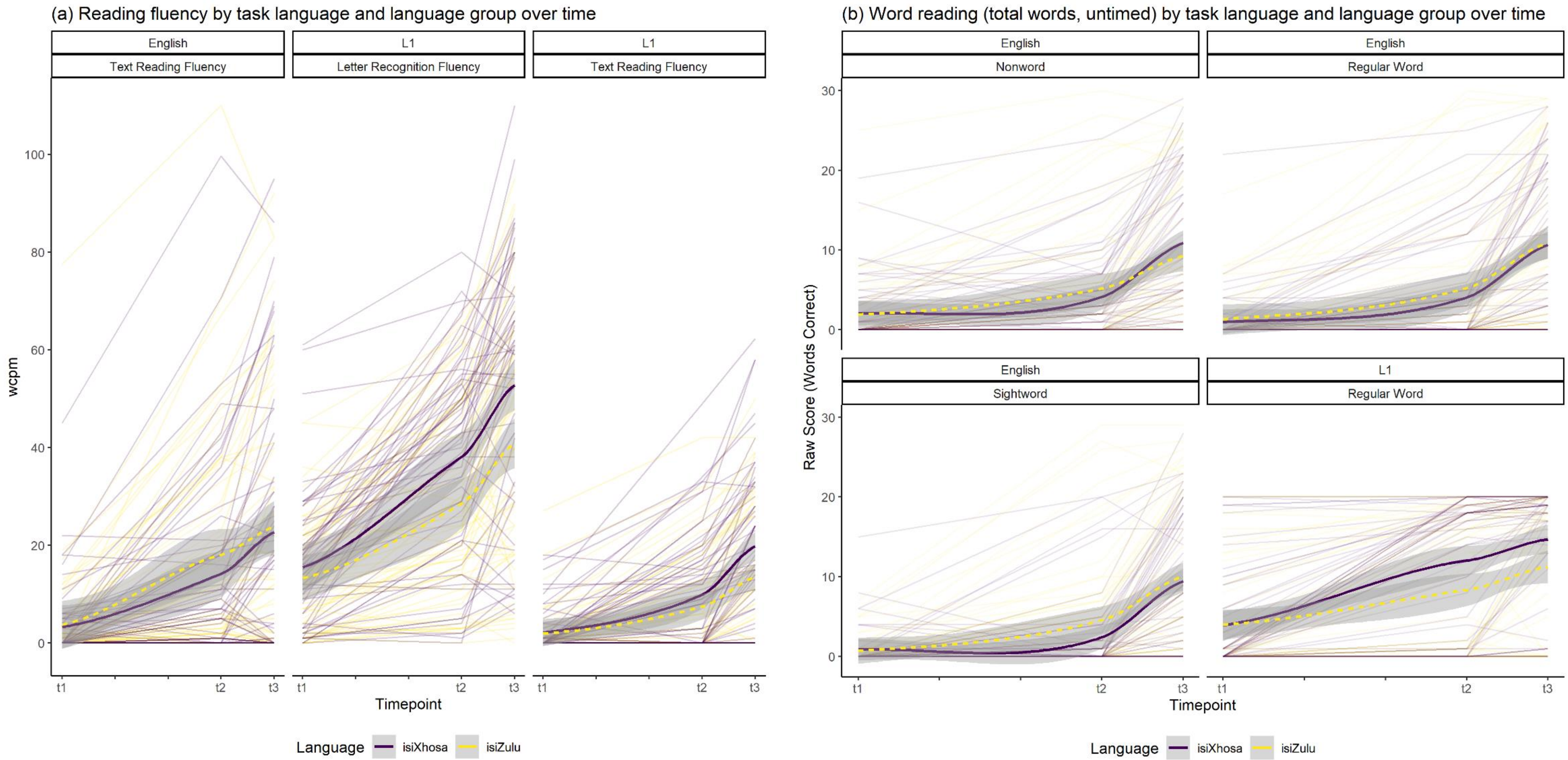


Figure 6-5. Developmental trajectory of reading fluency (a) and total words correct (b) with smoothed LOESS lines by task language and language group

Notes: The LOESS line is a weighted fitted line through the data points. It better indicates non-linear relationships in data. I use a LOESS line in these figures so that the elbow at t2 is clearer, i.e., very slow growth from t1 to t2 changes to faster growth between t2 and t3. The mixed models in Table *6-10* and Table *6-11* estimate linear relationships.

To examine the trajectory of isolated word reading development, I examined the total number of words read correctly per word reading task (*Table 6-11*, *Figure 6-5*). Total words read was recorded for each wave of data collection while time taken to read each list was recorded only at t2 and t3. The mixed effects model for L1 word reading (total words read correctly) had a similar pattern of results as L1 ORF. There was a significant main effect of time, and a significant and positive interaction of language and time (the isiXhosa group had a steeper slope than the isiZulu group over time). The English word reading tasks had significant main effects only of time (scores improved over time). Thus, the groups did not differ in their intercept or slope in English reading development. Across word reading tasks, the models estimate that the participants gained about 1 word per school term. The ICC was highest for L1 word reading (.62), and lowest for English sight word reading (.33). Thus, English sight word reading was least stable within person over time.

Table 6-11. Output of linear mixed effects models of the trajectory of word reading (untimed, total words correct) over time and by language group

	L1 Word Reading			**Eng Regular Word Reading**			**Eng Nonword Reading**			**Eng Sight Word Reading**		
Predictors	*Est.*	*se*	*p*	*Est.*	*se*	*p*	*Est.*	*se*	*p*	*Est.*	*se*	*p*
Intercept	3.887	0.904	**<.001**	0.884	0.873	.312	1.614	0.820	.050	0.285	0.772	.712
Time	0.866	0.102	**<.001**	1.069	0.121	**<.001**	0.827	0.104	**<.001**	1.035	0.115	**<.001**
Language[isiXhosa]	0.056	1.286	.965	-0.504	1.239	.684	-0.216	1.165	0.853	-0.093	1.096	.932
Time*Language	0.474	0.143	**.001**	-0.026	0.169	.878	0.096	0.146	0.513	-0.160	0.161	.322
Random Effects												
σ^2	22.14			31.53			23.23			28.69		
τ_{00}	36.23 $_{id}$			23.01 $_{id}$			24.87 $_{id}$			14.04 $_{id}$		
ICC	0.62			0.42			0.52			0.33		
N	140 $_{id}$			140 $_{id}$			140 $_{id}$			140 $_{id}$		
Observations	382			382			382			382		
Marginal R^2 / Conditional R^2	0.221 / 0.705			0.198 / 0.536			0.161 / 0.595			0.207 / 0.467		

Notes: model: *variable* ~ 1 + time + language + time*language + (1 | id).

Marginal R^2 = variance explained by fixed effects; Conditional R^2 = variance explained by entire model. With Bonferroni correction, p values below .0125 should be considered statistically significant.

Multilevel models were fit to the partial scores from t1 to t2 for the spelling of *imoto* and *dog*. These scores awarded credit for partially correct spelling, resulting in more variation in scores. Spelling also improved over time from t1 to t2 on these two words (*Table 6-12*, *Figure 6-6*). The main effect of time was positive and significant. Although the figure shows some difference between the isiXhosa and isiZulu groups, the main effect of language and its interaction with time was not significant for either word. The ICC was .58 for *imoto* and .51 for *dog* indicating moderate stability in spelling these words over time.

Table 6-12. Output of linear mixed effects models of spelling over time by language group

	L1: *imoto*			**Eng: *dog***		
Predictors	*Est.*	*se*	*p*	*Est.*	*se*	*p*
Intercept	2.277	0.254	**<0.001**	0.872	0.190	**<0.001**
Time	0.225	0.041	**<0.001**	0.178	0.033	**<0.001**
Language[isiXhosa]	0.520	0.361	0.150	0.114	0.270	0.674
Time*Language	0.082	0.058	0.160	0.028	0.047	0.552
Random Effects						
σ^2		1.88			1.23	
τ_{00}		2.65 $_{id}$			1.30 $_{id}$	
ICC		0.58			0.51	
N		140 $_{id}$			140 $_{id}$	
Observations		261			261	
Marginal R^2 / Conditional R^2		0.150 / 0.647			0.119 / 0.571	

Notes: model: *variable* ~ 1 + time + language + time*language + (1 | id)

Marginal R^2 = variance explained by fixed effects; Conditional R^2 = variance explained by entire model. With Bonferroni correction, p values below .025 should be considered statistically significant.

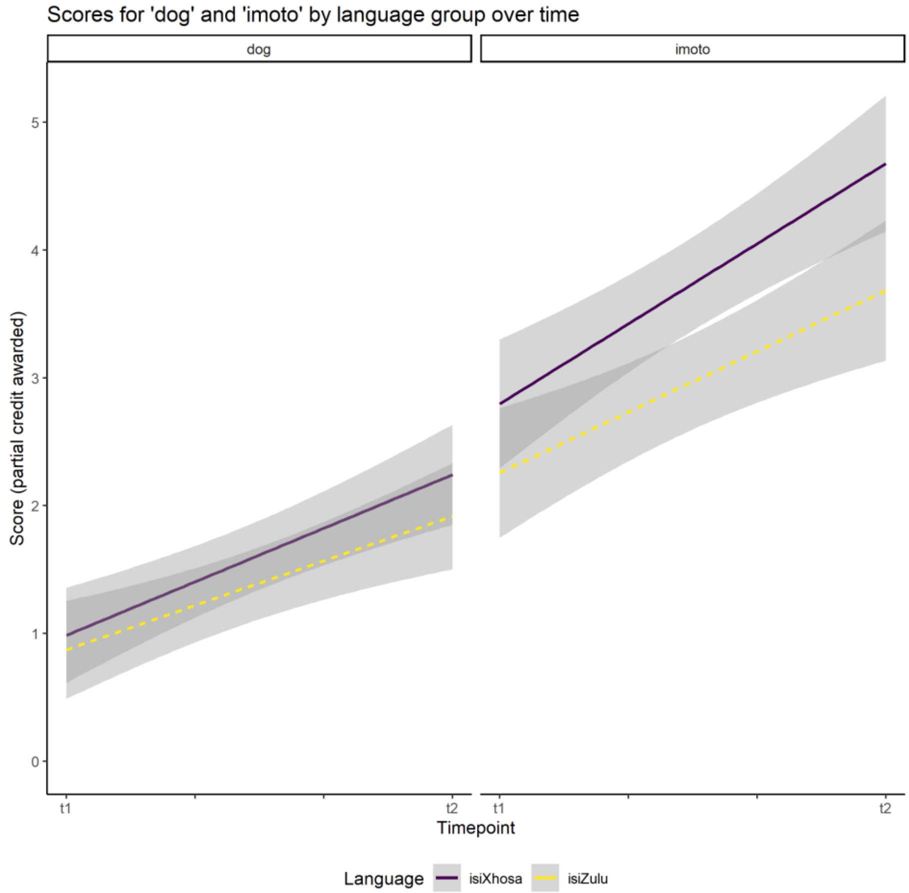


Figure 6-6. Developmental trajectory of spelling by language group

6.3.2.3 *Summary: Developmental trajectories by language group*

In summary, all skills improved over time, except for English blending, L1 RAN objects, and L1 digit span. The isiXhosa group had larger intercepts for L1 and English NWR (larger scores) at t1, and larger intercepts for English RAN Colours and English RAN Objects (slower times) at t1. The isiXhosa group had a less steep slope on average than the isiZulu group over time for all PWM tasks, except L1 digit span. The isiXhosa group had a steeper slope for LRF, L1 word reading accuracy and L1 oral reading fluency. Thus, even though the PA and RAN skills were overall quite similar for the isiXhosa and isiZulu groups, the isiXhosa group had faster growth in L1 reading. Since spelling was not scored at all three measurement points in the same way, it was not possible to determine the growth of spelling from t1 to t3. From t1 to t2, the groups did not differ significantly on spelling growth. The groups also did not differ significantly in the development of English reading skills.

The ICC also allowed examination of the stability of these task scores over time. That is, the ICC is also an indicator of the estimated correlation between two scores taken from the same task and individual over time. Most of the tasks had an ICC around .5, i.e., a moderate longitudinal correlation. The stability of task scores was very high for English isolation (ICC = .74). Lower values of ICC (< .40) were found for L1 RAN objects, L1 digit span, L1 NWR, English NWR, and English Sight Word Reading.

6.3.3 Phonological processing, vocabulary, and early letter recognition skills at t1 as longitudinal predictors of reading and spelling at t2 and t3

6.3.3.1 Longitudinal correlations between t1 variables and literacy variables at t2 and t3

The longitudinal correlations between the t1 predictors and the t2 and t3 literacy outcomes are presented in *Table 6-13* for the isiXhosa and isiZulu groups. For the full correlation matrix for all tasks and timepoints, readers are directed to the csv file online at https://osf.io/gmnws/.

For both groups, L1 vocabulary was weakly to moderately correlated with the t2 and t3 outcomes with r varying between .30 and .44. However, the English vocabulary correlations were generally weaker in the isiZulu (r = .10 - .30) than the isiXhosa group (r = .08 - .36). For example, the correlation between English vocabulary and t2 English reading fluency was r = .30 for the isiXhosa group and r = .09 for the isiZulu group. The correlations were consistent for t2 and t3 relations.

PA was moderately to strongly correlated with literacy outcomes (r = .40 - .70) with the exception of the L1 PA and t3 LRF correlation for the isiXhosa group which was weak (r = .25). The isiZulu group had slightly stronger correlations between PA and literacy, especially for L1 PA.

The digit span tasks were weakly to moderately correlated with literacy outcomes (r = .29 - .62). The pattern of correlations differed by language group. The isiXhosa group had slightly stronger correlations between L1 rather than English digit span and literacy outcomes. For example, t2 reading fluency correlated r = .51 with t1 L1 digit span, and r = .37 with English digit span for the isiXhosa group. The pattern was reversed for the isiZulu group, who had slightly stronger English digit span correlations than L1 digit span correlations. For example, t2 reading fluency correlated r = .37 with t1 L1 digit span, and r = .51 with English digit span for the isiZulu group. The exception to this pattern was the moderate correlation with reading comprehension which was stable for the language of administration, and language groups. For example, the L1 reading comprehension correlations were r = .50 (isiXhosa group) and r = .47 (isiZulu group) for L1 digit span, and r = .42 (isiXhosa group) and r = .43 (isiZulu group) for English digit span. With regards to English reading comprehension, correlations were r = .50 (isiXhosa group) and r = .46 (isiZulu group) for L1 digit span, and r = .44 (isiXhosa group) and r = .48 (isiZulu group) for English digit span. Thus, the reading fluency and spelling correlations with digit span were affected by language exposure (the digit span task children were more comfortable with had higher correlations), whereas reading comprehension was not affected by language exposure.

With regards to RAN, the relation between RAN and literacy outcomes differed by language group with stronger correlations observed in the isiZulu group. For the isiXhosa group, the L1 RAN objects and literacy correlations were very weak (r = .02 - .19) consistently at both time points, and for the isiZulu group the correlations ranged from weak to moderate (r = .25 - .43) and were slightly stronger at t3 than t2. Overall, the RAN digits task had stronger correlations with literacy than RAN objects. The RAN digits and literacy outcomes correlations were weak to moderate in the isiXhosa group (r = .30 - .53) and similar in strength at t2 and t3. For the isiZulu group, the RAN digits and literacy outcomes correlations were moderate to strong (r = .54 - .70) and similar in strength at t2 and t3. The LRF task, by virtue of being timed, was also examined in comparison to RAN correlations. The t1 letter sound recognition fluency correlation with literacy outcomes was moderate to strong for t2 and t3 (r = .48 - .81), and was therefore, stronger than the RAN digits and literacy correlations. The letter sound recognition fluency correlations were consistently weaker (by approximately .20) in the isiXhosa group.

The longitudinal literacy correlations were examined for interest and not included in the path analysis. The correlations differed by language group. For the isiXhosa group, most of the t1 reading and spelling correlations with t2 and t3 literacy were weak to moderate (r = .30 - .60). For the isiZulu group, most correlations were in the moderate to strong range (r = .50 - .70). Thus, there was more longitudinal stability in literacy skills in the isiZulu group. The t1 letter sound recognition fluency correlation with t2 and t3 literacy outcomes was often of equal strength or stronger than the t1 literacy variables' correlation with t2 and t3 literacy variables. Thus, letter-recognition fluency shared a lot of variance with the later literacy outcomes.

Table 6-13. Pearson correlations between t1 variables and reading and spelling outcomes in t2 and t3

	t1 variables		L1 Vocab.	L1 PA	L1 Digit Span	L1 RAN Objects	L1 Letter Rec. Fluency	L1 Reading Fluency	L1 Spelling	Eng Vocab.	Eng PA	Eng Digit Span	Eng RAN Digits	Eng Reading Fluency	Eng Spelling
t2	**L1 Letter Rec. Fluency**	X	.30	.47	.43	.19	.65	.44	.49	.28	.53	.35	.51	.31	.41
		Z	.34	.67	.29	.25	.74	.49	.67	.20	.72	.51	.64	.45	.54
	L1 Reading Fluency	X	.26	.60	.51	.10	.57	.57	.53	.37	.66	.37	.48	.47	.49
		Z	.39	.73	.37	.25	.81	.84	.64	.10	.66	.50	.72	.77	.58
	L1 Spelling	X	.35	.51	.43	.02	.55	.48	.59	.28	.56	.36	.30	.36	.51
		Z	.43	.73	.47	.31	.80	.63	.76	.26	.72	.62	.69	.57	.66
	Eng Reading Fluency	X	.24	.49	.41	.18	.48	.61	.47	.30	.66	.36	.41	.73	.51
		Z	.30	.68	.36	.28	.80	.86	.51	.09	.62	.47	.65	.81	.53
	Eng Spelling	X	.37	.42	.44	.08	.50	.45	.5	.28	.61	.34	.38	.42	.51
		Z	.39	.74	.36	.31	.74	.70	.74	.23	.68	.56	.64	.65	.6
t3	**L1 Letter Rec. Fluency**	X	.30	.25	.28	.11	.49	.34	.39	.09	.4	.20	.30	.18	.33
		Z	.35	.56	.20	.34	.63	.44	.59	.10	.53	.37	.57	.41	.39
	L1 Reading Fluency	X	.31	.55	.50	.18	.64	.51	.48	.25	.64	.39	.53	.34	.49
		Z	.36	.71	.35	.35	.79	.72	.63	.02	.61	.44	.68	.63	.5
	L1 Reading Comp.	X	.44	.52	.50	.09	.67	.53	.71	.25	.67	.42	.45	.39	.53
		Z	.36	.71	.47	.28	.68	.55	.63	.10	.67	.43	.60	.51	.51
	L1 Spelling	X	.30	.41	.35	.07	.56	.43	.53	.14	.51	.27	.38	.32	.54
		Z	.43	.72	.44	.43	.76	.63	.70	.15	.68	.48	.70	.56	.62
	Eng Reading Fluency	X	.28	.34	.44	.16	.41	.35	.46	.29	.51	.36	.45	.38	.33
		Z	.32	.64	.31	.39	.74	.71	.58	.02	.57	.49	.70	.65	.51
	Eng Reading Comp.	X	.29	.35	.50	.00	.29	.38	.44	.36	.53	.44	.14	.41	.25
		Z	.34	.63	.46	.36	.63	.59	.59	.24	.69	.48	.53	.52	.63
	Eng Spelling	X	.30	.54	.37	.19	.62	.62	.52	.27	.71	.28	.48	.58	.58
		Z	.31	.70	.43	.29	.69	.77	.65	.08	.57	.46	.54	.67	.65

Notes: Correlations for the isiZulu group are shaded.

6.3.3.2 *Describing the path analyses: t1 predictors of t2 and t3 literacy*

Path analysis models were used to determine the longitudinal relation between t1 phonological processing, t1 vocabulary and t1 LRF and literacy measured in grade 3, i.e., t2 reading fluency and spelling, and t3 reading fluency, spelling, and reading comprehension. As was done in chapters 5 and 6, the reading and spelling variables were reduced into one variable using principal components analysis at each timepoint. One reading comprehension variable in each language at t3 was also calculated using principal components analysis from the percentage scores on the oral and written reading comprehension questions. As per chapter 5, the t1 predictors were L1 PA, English PA, English RAN digits, L1 RAN Objects, L1 digit span, English digit span, L1 vocabulary and English vocabulary. The PA scores per task language were derived from principal components analysis as the CFA in chapter 5 indicated that PA is best conceptualised as correlated language specific constructs in first grade. Observed variables were used for RAN because many children were not able to complete the letters task, and the English colours and objects tasks, thus reducing the sample size drastically. The observed digit span scores were used because the correlations within language differed for the isiXhosa and isiZulu groups, and NWR did not load sufficiently on the latent PWM factor. In this analysis, t1 LRF was a predictor along with the phonological processing skills. T2 and t3 LRF was included as an outcome in the t2 and t3 models.

Five multigroup path models were fit to the data for the different outcomes: t2 reading fluency, t3 reading fluency, t2 spelling, t3 spelling, t3 reading comprehension. LRF at the same timepoint was included as an outcome as well. These models had the same format. With the exception of LRF, the L1 and English outcome variable had a direct path from all the predictors: t1 LRF, L1 PA, English PA, English RAN digits, L1 RAN Objects, L1 digit span, English digit span, L1 vocabulary and English vocabulary. LRF at t2 and t3 was predicted by these same predictors except for English digit span. This ensured that the model could be identified, and model fit indices estimated. The outcome variables were specified to be correlated. All coefficients were allowed to be freely estimated within each group. The equality of constraints in the language groups was checked to determine if the relations were the same for the isiXhosa and isiZulu groups. The model fit indices and coefficients are presented for each model below.

6.3.3.3 *Grade 1 predictors of reading fluency at t2*

The first model examined t1 predictors of t2 reading fluency. Four participants were removed from the analysis for being outliers on the reading fluency scores. The MGCFA where all parameters were freely estimated indicated good fit of this model to the data, scaled χ^2 (2) = 0.801, p = .670, scaling factor = 0.884, robust CFI = 1.000, robust TLI = 1.085, robust RMSEA = 0, 90% CI [0; .183], SRMR = .004. The model did not fit the data (the model was unidentified) when the regressions were constrained to be equal, and also did not fit the data when the correlations among the outcomes were constrained to be equal. Thus, there is evidence to suggest that the longitudinal relations are not equal between the isiXhosa and isiZulu groups. The results of the model are presented in *Table 6-14* and the path diagram is visualised in *Figure 6-7*.

Table 6-14. Standardised coefficients of t1 predictors of t2 letter recognition and t2 reading fluency

	t2 Letter Recognition				**t2 L1 Reading Fluency**				**t2 Eng Reading Fluency**			
	isiXhosa		**isiZulu**		**isiXhosa**		**isiZulu**		**isiXhosa**		**isiZulu**	
Variables	**β**	**p**	**β**	**p**	**β**	**p**	**β**	**p**	**β**	**p**	**β**	**p**
t1 LR Fluency	0.49	**.000**	0.30	**.041**	0.18	.105	0.27	.094	0.15	.136	0.29	**.020**
t1 L1 PA	-0.04	.785	-0.01	.922	0.09	.469	0.11	.452	-0.03	.793	0.00	.975
t1 Eng PA	-0.16	.301	0.48	**.000**	-0.06	.712	0.16	.180	0.20	.249	0.18	.181
t1 Eng RAN Digits	0.34	**.009**	0.36	**.002**	0.51	**.002**	0.38	**.001**	0.32	**.031**	0.32	**.017**
t1 L1 RAN Objects	-0.19	.106	-0.17	.053	-0.34	**.017**	-0.12	.118	-0.09	.481	0.02	.863
t1 L1 Digit Span	0.25	**.028**	-0.04	.587	0.31	**.004**	0.08	.271	0.15	.192	0.10	.207
t1 Eng Digit Span	-	-	-	-	0.11	.279	0.06	.445	0.16	.070	0.10	.295
t1 L1 Vocab	-0.02	.905	-0.13	.116	-0.18	.106	0.10	.242	-0.18	.050	0.07	.536
t1 Eng Vocab	0.32	**.004**	0.00	.993	0.33	**.000**	-0.12	.110	0.37	**.000**	-0.16	**.033**
R^2	.533		.710		.596		.727		.537		.673	

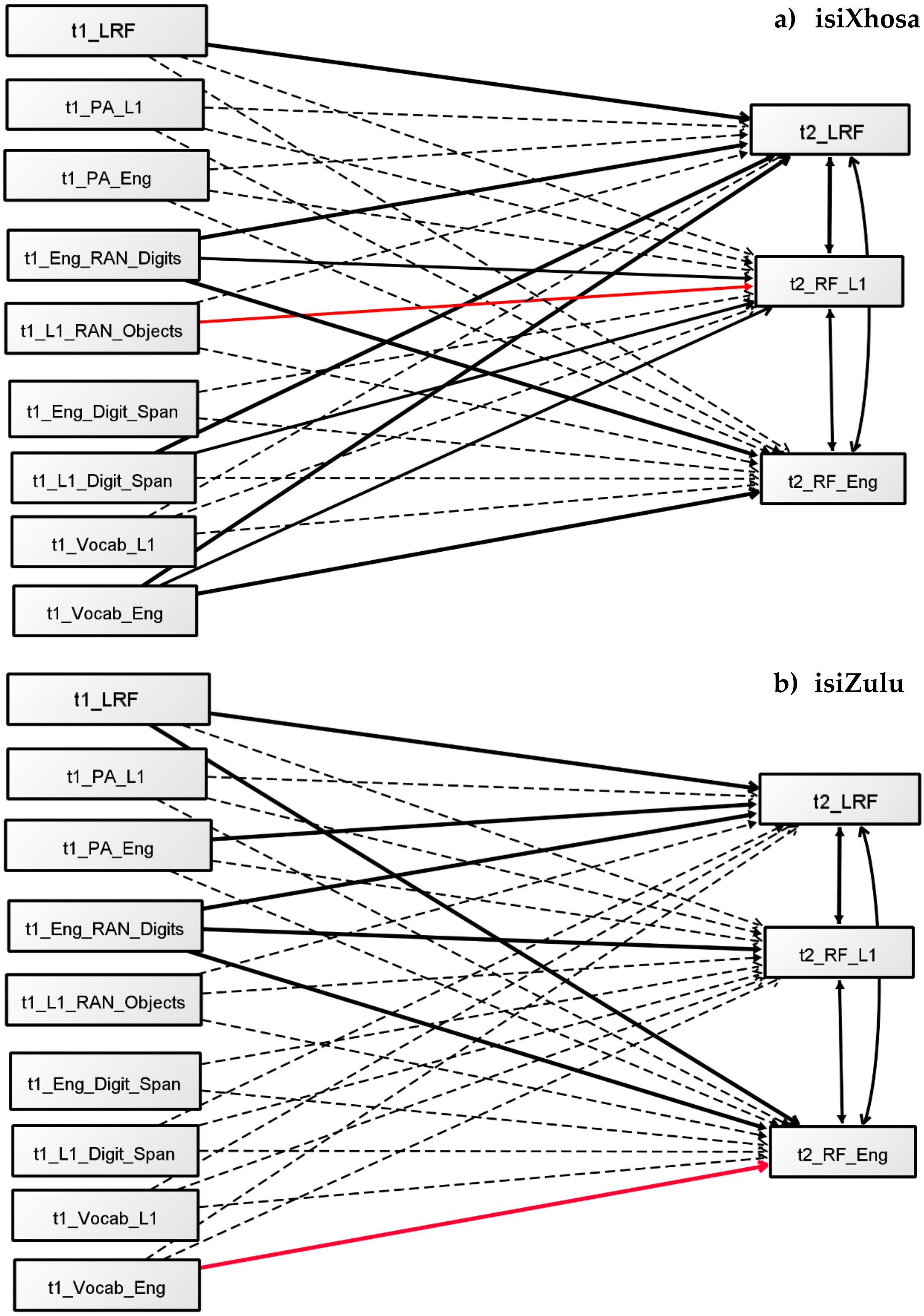


Figure 6-7. Path diagrams of t1 predictors of t2 LRF and t2 reading fluency for the (a) isiXhosa and (b) isiZulu groups

For both groups, LRF at t2 was significantly predicted by t1 LRF (Xhosa: β = .49, Zulu: β = .30) and English RAN digits (Xhosa: β = .34, Zulu: β = .36) at t1. Thus, unlike the cross-sectional analyses presented in chapter 5 and chapter 6, English RAN digits was a predictor independently from LRF. The groups differed on the other predictors. In the isiXhosa group, L1 digit span (β = .25) and English vocabulary (β = .32) also positively predicted t2 LRF. For the isiZulu group, t1 English PA (β = .48) also predicted t2 LRF.

English RAN digits was a significant predictor of t2 reading fluency in L1 (Xhosa: β = .51, Zulu: β = .38) and English (Xhosa: β = .32, Zulu: β = .32) for both language groups. Thus, it was a consistent predictor of reading fluency at t2 with a similar effect size across the letter reading fluency and reading fluency composite scores. For the isiXhosa group, English vocabulary was positively related to reading fluency in L1 (β = .33) and English (β = .37). For the isiZulu group, English vocabulary significantly predicted only English reading fluency, and the relation was negative (β = -.16). In the isiXhosa group, L1 digit span (β = .31) was an additional significant predictor of L1 reading fluency at t2, and L1 RAN Objects (β = -.34) was negatively predictive of L1 reading fluency. The negative effect of L1 RAN Objects may be due to suppression (Logan et al., 2011), and is discussed in chapter 7.

Overall, the models explained a sizeable proportion of variance in the outcome variables. Approximately 50 – 60% of the variance in the outcomes was explained for the isiXhosa group, with more variance explained in the isiZulu group (67 – 73%).

6.3.3.4 Grade 1 predictors of spelling at t2

The second model examined t1 predictors of t2 LRF and t2 spelling. The MGCFA where all parameters were freely estimated indicated good fit of this model to the data, scaled χ^2 (2) = 0.801, p = .670, scaling factor = 0.884, robust CFI = 1.000, robust TLI = 1.090, robust RMSEA = 0, 90% CI [0; .183], SRMR = .004. The model did not fit the data (the model was unidentified) when the regressions were constrained to be equal, and neither when the correlations among the outcomes were constrained to be equal. The results of the model are presented in *Table 6-15* and the path diagram is visualised in *Figure 6-8*.

The predictors of t2 LRF were addressed in the previous section and are not repeated here. T1 LRF was a significant predictor of t2 spelling in L1 (X: β = .36, Z: β = .37), but not English, for both groups. Additionally, for the isiZulu group, English RAN digits (β = .25), L1 digit span (β = .16) and English digit span (β = .15) were significantly and positively predictive of t2 L1 reading fluency. L1 digit span (β = .23) was the only significant predictor of English spelling for the isiXhosa group. For the isiZulu group, only L1 PA (β = .31) and English RAN Digits (β = .25) were significant predictors of t2 English spelling.

Overall, the models explained a sizeable proportion of variance in the outcome variables. The variables accounted for less variance in the spelling, than the reading fluency, outcomes for the isiXhosa group. Approximately 49% and 43% of the variance in L1 and English spelling was accounted for by the variables. For the isiZulu group, this was approximately 80% and 65%.

Table 6-15. Standardised coefficients of t1 predictors of t2 letter recognition and spelling

	t2 Letter Recognition				**t2 L1 Spelling**				**t2 Eng Spelling**			
	isiXhosa		**isiZulu**		**isiXhosa**		**isiZulu**		**isiXhosa**		**isiZulu**	
Predictors	**β**	**p**	**β**	**p**	**β**	**p**	**β**	**p**	**β**	**p**	**β**	**p**
t1 LR Fluency	0.49	**.000**	0.30	**.041**	0.36	**.028**	0.37	**.000**	0.20	.235	0.14	.518
t1 L1 PA	-0.04	.785	-0.01	.922	0.19	.149	0.08	.535	-0.11	.517	0.31	**.017**
t1 Eng PA	-0.16	.301	0.48	**.000**	0.03	.871	0.15	.156	0.25	.141	0.10	.491
t1 Eng RAN Digits	0.34	**.009**	0.36	**.002**	0.03	.847	0.25	**.004**	0.28	.091	0.25	**.045**
t1 L1 RAN Objects	-0.19	.106	-0.17	.053	-0.18	.140	-0.04	.597	-0.18	.116	0.00	.956
t1 L1 Digit Span	0.25	**.028**	-0.04	.587	0.16	.210	0.16	**.033**	0.23	**.046**	0.03	.741
t1 Eng Digit Span	-	-	-	-	-0.03	.679	0.15	**.005**	-0.05	.615	0.15	.072
t1 L1 Vocab	-0.02	.905	-0.13	.116	0.10	.477	0.03	.711	0.07	.545	0.02	.830
t1 Eng Vocab	0.32	**.004**	0.00	.993	0.22	.050	0.06	.324	0.19	.105	0.08	.277
R^2	.533		.710		.489		.799		.430		.646	

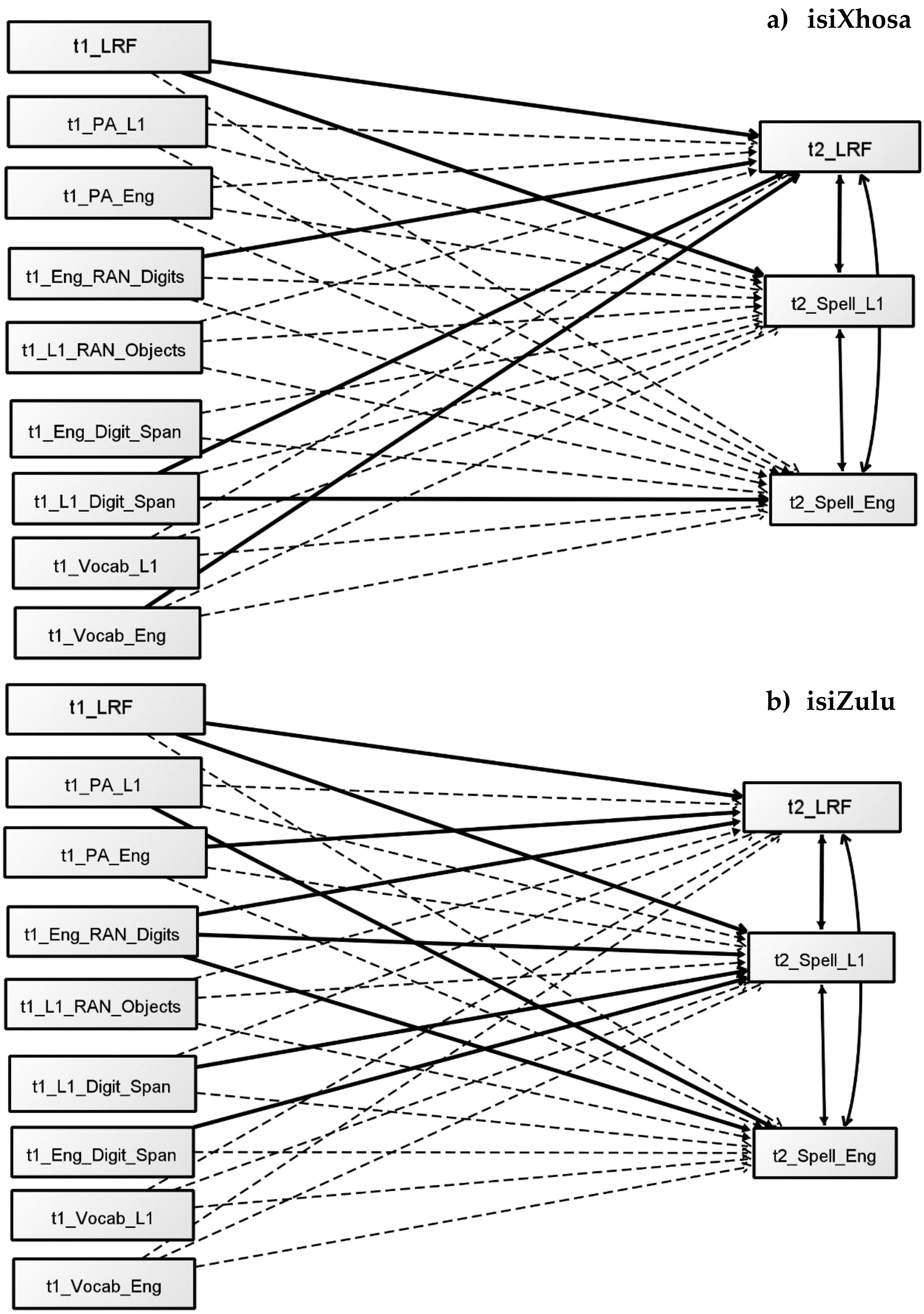


Figure 6-8. Path diagrams of t1 predictors of t2 LRF and t2 spelling for the (a) isiXhosa and (b) isiZulu groups

6.3.3.5 *Grade 1 predictors of reading fluency at t3*

The third model examined t1 predictors of t3 LRF and t3 reading fluency. The MGCFA where all parameters were freely estimated indicated good fit of this model to the data, scaled χ^2 (2) = 1.126, p = .569, scaling factor = 0.749, robust CFI = 1.000, robust TLI = 1.053, robust RMSEA = 0, 90% CI [0; .186], SRMR = .005. The model did not fit the data (the model was unidentified) when the regressions were constrained to be equal, and neither when the correlations among the outcomes were constrained to be equal. The results of the model are presented in *Table 6-16* and visualised in *Figure 6-9*.

Table 6-16. Standardised coefficients of t1 predictors of t3 letter recognition and t3 reading fluency

	t3 Letter Recognition				**t3 L1 Reading Fluency**				**t3 Eng Reading Fluency**			
	isiXhosa		**isiZulu**		**isiXhosa**		**isiZulu**		**isiXhosa**		**isiZulu**	
Variables	**β**	**p**	**β**	**p**	**β**	**p**	**β**	**p**	**β**	**p**	**β**	**p**
t1 LR Fluency	0.42	**.040**	0.34	.196	0.22	.107	0.45	**.028**	0.07	.593	0.28	.071
t1 L1 PA	-0.13	.441	0.05	.743	-0.03	.823	0.11	.457	-0.21	.077	0.08	.633
t1 Eng PA	0.07	.698	0.14	.411	0.10	.535	0.07	.594	0.22	.277	0.04	.755
t1 Eng RAN Digits	0.16	.348	0.24	.077	0.38	**.012**	0.23	.059	0.35	.079	0.33	**.004**
t1 L1 RAN Objects	-0.04	.695	0.02	.864	-0.17	.187	0.02	.796	-0.07	.636	0.10	.219
t1 L1 Digit Span	0.12	.413	-0.01	.906	0.31	**.002**	0.12	.095	0.34	**.004**	0.07	.345
t1 Eng Digit Span	-	-	-	-	0.09	.417	0.00	.961	-0.03	.777	0.15	**.039**
t1 L1 Vocab	0.01	.950	0.02	.865	-0.10	.403	0.05	.622	-0.03	.798	0.01	.955
t1 Eng Vocab	0.09	.486	-0.01	.891	0.19	.074	-0.13	.068	0.30	**.013**	-0.12	.178
R^2	.299		.478		.490		.698		.408		.625	

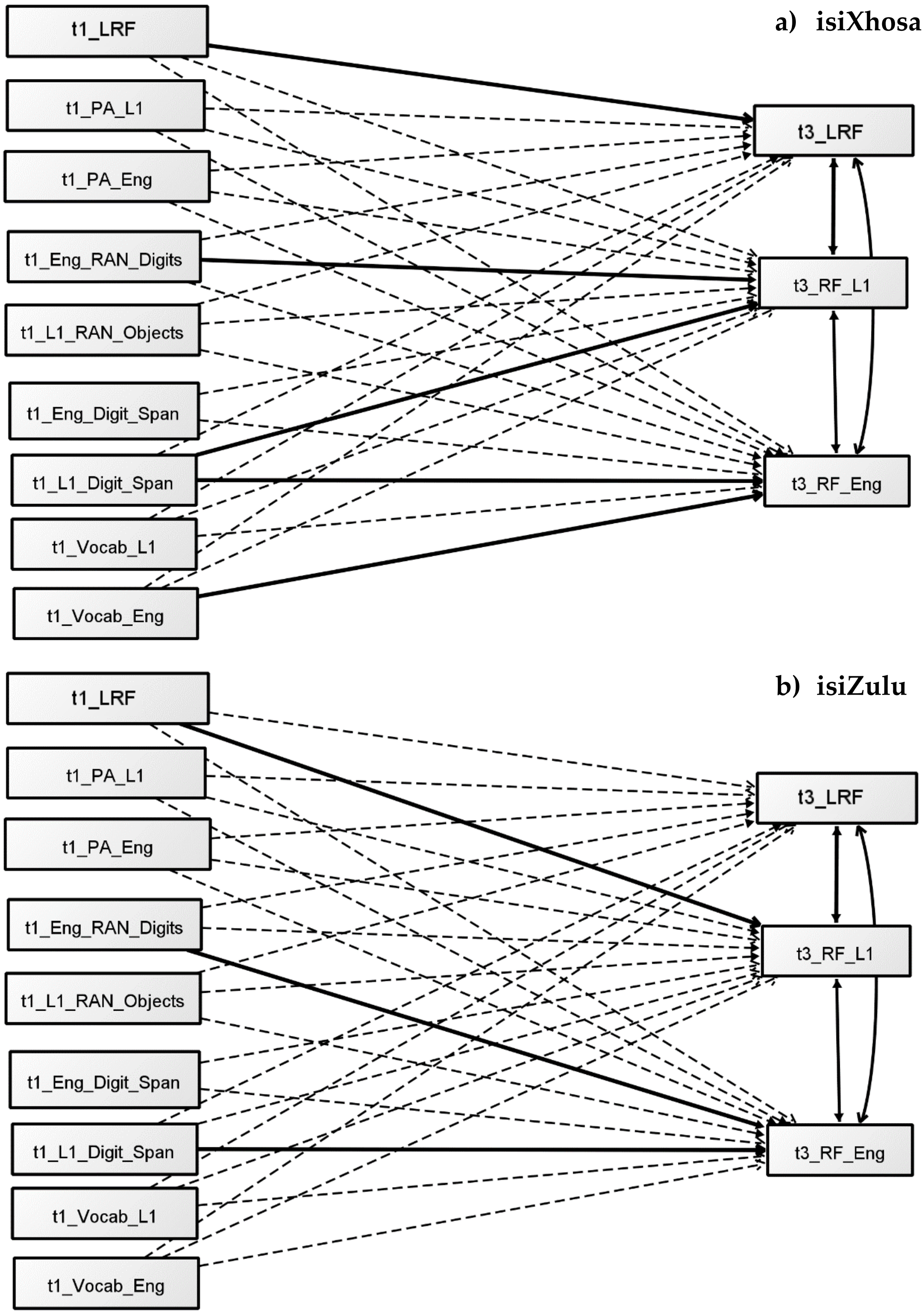


Figure 6-9. Path diagrams of t1 predictors of t3 LRF and t3 reading fluency for the (a) isiXhosa and (b) isiZulu groups

At t3, LRF was predicted by t1 LRF (β = .42) in the isiXhosa group only. None of the included variables were significantly predictive of t3 LRF in the isiZulu group. The variables that significantly predicted t3 reading fluency varied by language group.

For the isiXhosa group, L1 digit span measured at t1 significantly predicted t3 reading fluency in L1 (β = .31) and English (β = .34). L1 reading fluency for this group was also predicted by English RAN Digits (β = .38). The isiXhosa group's English reading fluency was also significantly predicted by English vocabulary (β = .30). None of the other t1 variables, including t1 LRF, significantly predicted reading fluency for this group.

For the isiZulu group, t1 LRF (β = .45) was the only significant predictor of t3 L1 reading fluency. Their English reading fluency was predicted by digit span measured in English (β = .15). English RAN digits was also a significant predictor (β = .33) of English reading fluency. The other t1 variables did not significantly predict English reading fluency.

The variance accounted for by the predictors for t3 reading fluency outcomes was lower than for t2 reading fluency outcomes. The t1 predictors accounted for 49% and 41% of the L1 and English t3 reading fluency for the isiXhosa group and 70% and 63% for the isiZulu group. Thus, as at t2, more variance was explained by the predictors in the isiZulu group.

6.3.3.6 Grade 1 predictors of spelling at t3

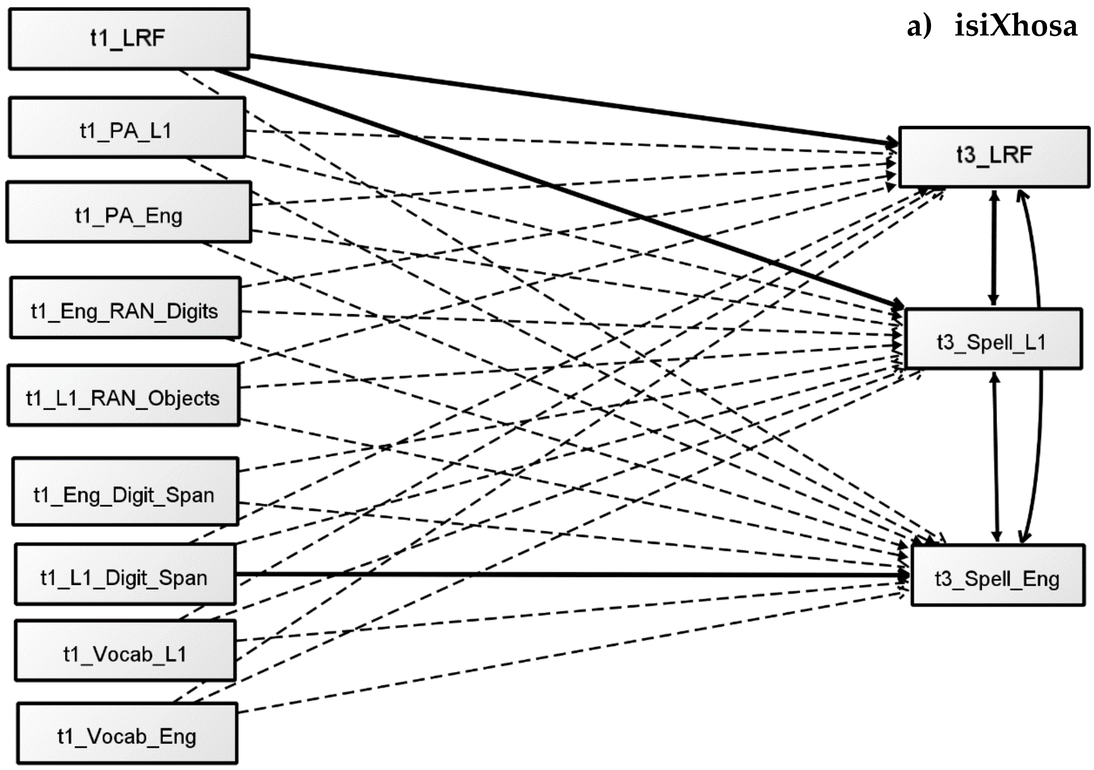
The fourth model examined t1 predictors of t3 LRF and t3 spelling. The MGCFA where all parameters were freely estimated indicated good fit of this model to the data, scaled χ^2 (2) = 1.126, p = .569, scaling factor = 0.749, robust CFI = 1.000, robust TLI = 1.080, robust RMSEA = 0, 90% CI [0; .186], SRMR = .005. The model did not fit the data (the model was unidentified) when the regressions were constrained to be equal, and neither when the correlations among the outcomes were constrained to be equal. The results of the model are presented in Table *6-17* and visualised in Figure *6-10*.

The predictors of t3 LRF were addressed in the previous section and are not repeated here. Again, the predictors of the outcome of spelling differed by language group. For the isiXhosa group, only t1 LRF (β = .48) significantly predicted t3 L1 spelling. None of the t1 predictors significantly predicted English spelling for this group. For the isiZulu group, L1 digit span significantly predicted both L1 (β = .25) and English (β = .19) spelling. English RAN digits (β = .29) significantly predicted L1 spelling for the isiZulu group. L1 PA (β = .36) significantly predicted English spelling for the isiZulu group.

With regards to variance accounted for by the model, again, there was a drop compared to t2. The variables accounted for 46% and 41% of t3 L1 and English spelling for the isiXhosa group, and 75% and 57% for the isiZulu group. The models, again, accounted for more variance in L1 spelling than English spelling, and more variance for the isiZulu than the isiXhosa group.

Table 6-17. Standardised coefficients of t1 predictors of t3 letter recognition and t3 spelling

	t3 Letter Recognition				**t3 L1 Spelling**				**t3 Eng Spelling**			
	isiXhosa		**isiZulu**		**isiXhosa**		**isiZulu**		**isiXhosa**		**isiZulu**	
Predictors	**β**	**p**	**β**	**p**	**β**	**p**	**β**	**p**	**β**	**p**	**β**	**p**
t1 LR Fluency	0.42	**.040**	0.34	.196	0.48	**.002**	0.29	.086	0.27	.079	0.24	.168
t1 L1 PA	-0.13	.441	0.05	.743	-0.01	.944	0.10	.411	-0.09	.456	0.36	**.016**
t1 Eng PA	0.07	.698	0.14	.411	0.14	.389	0.11	.220	0.49	.071	-0.07	.692
t1 Eng RAN Digits	0.16	.348	0.24	.077	0.15	.332	0.29	**.007**	0.08	.635	0.09	.498
t1 L1 RAN Objects	-0.04	.695	0.02	.864	-0.13	.283	0.13	.065	-0.03	.851	0.07	.471
t1 L1 Digit Span	0.12	.413	-0.01	.906	0.10	.331	0.25	**.000**	0.05	.705	0.19	**.024**
t1 Eng Digit Span	-	-	-	-	0.00	.961	-0.01	.777	0.05	.767	0.08	.410
t1 L1 Vocab	0.01	.950	0.02	.865	-0.03	.863	0.05	.546	-0.16	.251	0.08	.520
t1 Eng Vocab	0.09	.486	-0.01	.891	0.09	.446	0.01	.907	0.08	.398	-0.05	.634
R^2	0.299		0.478		0.463		0.751		0.414		0.570	



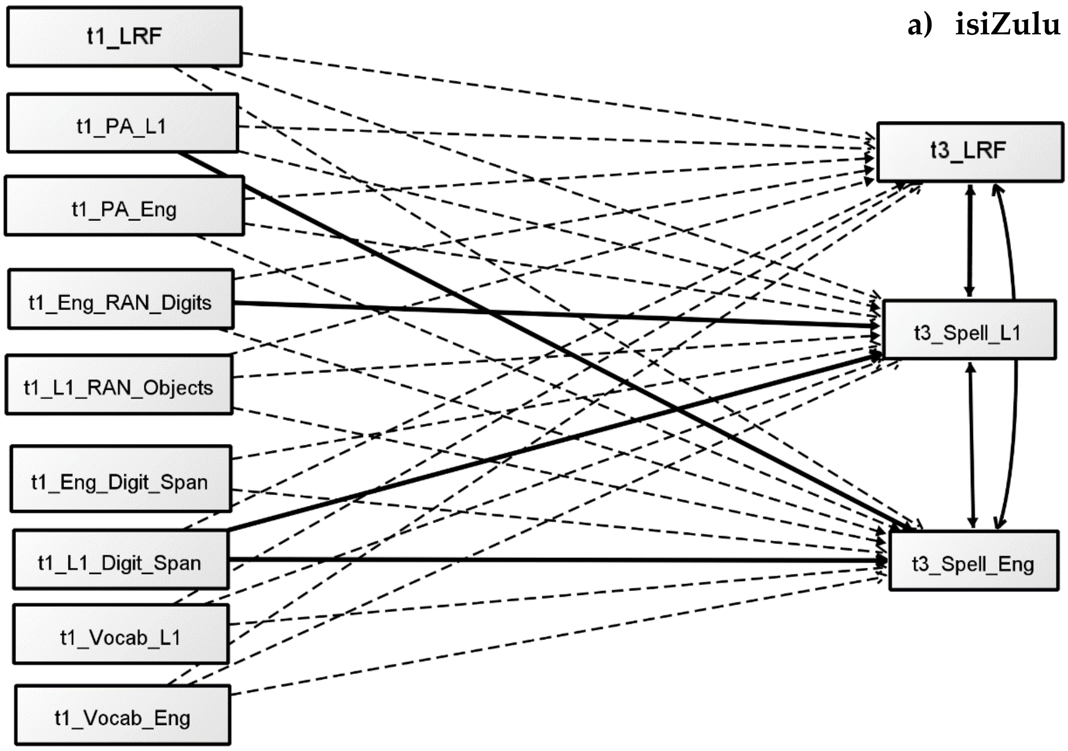


Figure 6-10. Path diagrams of t1 predictors of t3 LRF and t3 spelling for the (a) isiXhosa and (b) isiZulu groups

6.3.3.7 *Grade 1 predictors of reading comprehension at t3*

The fifth model examined t1 predictors of t3 LRF and t3 reading comprehension. The MGCFA where all parameters were freely estimated indicated good fit of this model to the data, scaled χ^2 (2) = 1.126, p = .569, scaling factor = 0.749, robust CFI = 1.000, robust TLI = 1.076, robust RMSEA = 0, 90% CI [0; .186], SRMR = .005. The model did not fit the data (the model was unidentified) when the regressions were constrained to be equal, and neither when the correlations among the outcomes were constrained to be equal. The results of the model are presented in *Table 6-18* and visualised in *Figure 6-11*.

Table 6-18. Standardised coefficients of t1 predictors of t3 letter recognition and reading comprehension

	t3 Letter Recognition				**t3 L1 Reading Comprehension**				**t3 Eng Reading Comprehension**			
	isiXhosa		**isiZulu**		**isiXhosa**		**isiZulu**		**isiXhosa**		**isiZulu**	
Variables	**β**	**p**	**β**	**p**	**β**	**p**	**β**	**p**	**β**	**p**	**β**	**p**
t1 LR Fluency	0.42	**.040**	0.34	.196	0.47	**.000**	0.13	.449	-0.07	.602	0.09	.565
t1 L1 PA	-0.13	.441	0.05	.743	-0.07	.521	0.20	.172	-0.14	.263	0.03	.879
t1 Eng PA	0.07	.698	0.14	.411	0.19	.146	0.23	.137	0.34	.159	0.32	**.023**
t1 Eng RAN Digits	0.16	.348	0.24	.077	0.12	.330	0.27	.074	0.00	.993	0.18	.292
t1 L1 RAN Objects	-0.04	.695	0.02	.864	-0.14	.050	0.00	.985	-0.06	.724	0.16	.099
t1 L1 Digit Span	0.12	.413	-0.01	.906	0.21	**.031**	0.26	**.004**	0.24	.052	0.26	**.016**
t1 Eng Digit Span	-	-	-	-	0.03	.754	-0.04	.647	0.29	.052	0.08	.432
t1 L1 Vocab	0.01	.950	0.02	.865	0.07	.564	0.02	.828	-0.08	.529	-0.04	.693
t1 Eng Vocab	0.09	.486	-0.01	.891	0.14	.160	-0.06	.434	0.20	.095	0.08	.437
R^2	.299		.478		.594		.648		.392		.576	

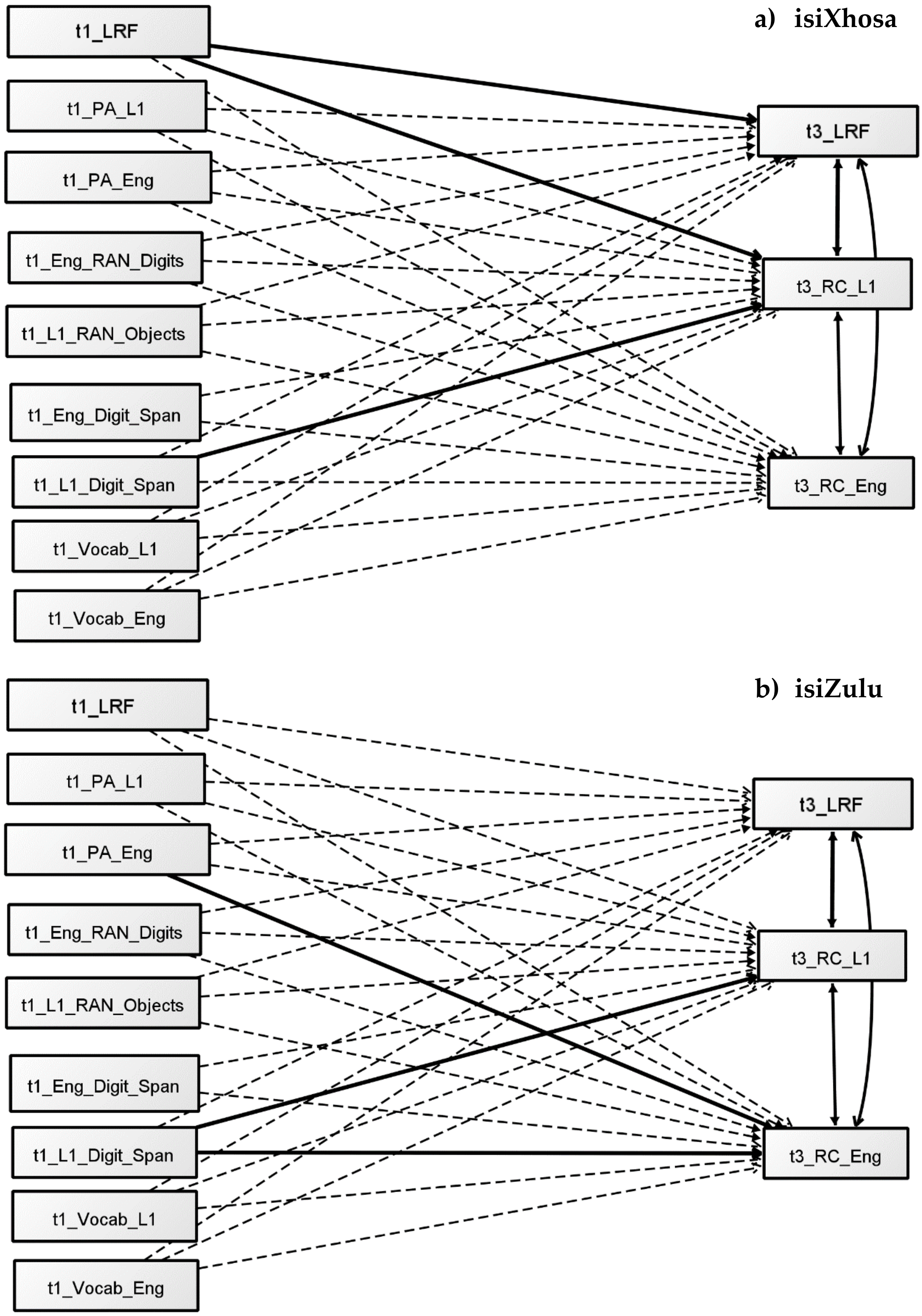


Figure 6-11. Path diagrams of t1 predictors of t3 LRF and t3 reading comprehension for the (a) isiXhosa and (b) isiZulu groups

The predictors of t3 LRF were addressed in the previous section and are not repeated here. L1 reading comprehension was predicted by L1 digit span for both language groups (X: $\beta = .21$, Z: $\beta = .26$). L1 digit span was the only significant predictor of L1 reading comprehension for the isiZulu group. In the isiXhosa group, t1 LRF ($\beta = .47$) was also a significant predictor of L1 reading comprehension.

None of the t1 variables were significantly related to English reading comprehension for the isiXhosa group, although the L1 and English digit span tasks had p values of .052. For the isiZulu group, English reading comprehension was predicted by English PA ($\beta = .32$) and L1 digit span ($\beta = .26$).

The models accounted for a large proportion of the variance in reading comprehension. The proportion explained in L1 reading comprehension was similar for the isiXhosa (59%) and isiZulu (65%).

6.3.3.8 Summary: path analyses of t1 predictors of t2 and t3 literacy outcomes

The longitudinal relations differed by language group and timepoint and were not necessarily specific to each outcome. Firstly, the variance accounted for in the models was higher for the t1 to t2 longitudinal relation than the t1 to t3 longitudinal relation. Secondly, more variance in the outcomes was accounted for by the models for the isiZulu than the isiXhosa group at both timepoints. The exception was t3 L1 reading comprehension which had a similar proportion of variance explained.

Some predictors were related to various outcomes for both language groups. LRF at t1 predicted t2 LRF and t2 L1 spelling. English RAN digits predicted t2 L1 reading fluency and t2 English reading fluency. L1 digit span predicted t3 L1 reading comprehension. L1 vocabulary did not predict any of the outcomes at any timepoint in either group.

The longitudinal relation of PA to literacy differed by language group. Neither L1 nor English PA emerged as significant longitudinal predictors of t2 and t3 literacy outcomes for the isiXhosa group. There was cross-language transfer of L1 PA on English spelling at t2 and t3 for the isiZulu group. English PA was longitudinally related to English reading comprehension for the isiZulu group. At t3, English RAN digits predicted t3 L1 reading fluency for the isiXhosa but not the isiZulu group, and English RAN digits predicted t3 English reading fluency for the isiZulu but not the isiXhosa group. Additionally, for the isiZulu group, RAN digits had longitudinal relations to t2 spelling in L1 and English, and t3 spelling in L1. L1 RAN objects was not significantly related to literacy outcomes, with the exception of t2 reading fluency for the isiXhosa group, which could be an indication of suppression (more detail provided in chapter 7). L1 digit span was a longitudinal predictor of half the literacy outcomes although not always of the same outcome for the language groups. For the isiXhosa group, L1 digit span significantly predicted t2 LRF, t2 and t3 L1 reading fluency, t3 English reading fluency, and t2 English spelling. For the isiZulu group, t1 L1 digit span predicted t1 and t2 L1 spelling, t3 English spelling, and t3 English reading comprehension. Already mentioned above is the role of L1 digit span in L1 reading comprehension for both groups. Thus, L1 digit span influenced reading fluency in the isiXhosa group, and spelling in the isiZulu group. English digit span at t1 predicted t3 English reading fluency for the isiZulu group. English digit span had no other significant relations in either group. The role of vocabulary was unexpected given the cross-sectional results. English vocabulary negatively predicted t2 English reading fluency in the isiZulu group, but positively predicted the same outcome in the isiXhosa group. English vocabulary positively predicted reading fluency of letters and texts (L1 and English) in the isiXhosa group. The positive relation was also present for t3 English reading fluency in the isiXhosa group.

6.3.4 Phonological processing and early letter recognition skills at t2 as longitudinal predictors of reading and spelling at t3

Between t1 and t2, the participants received limited instruction because of the COVID-19 pandemic related school closures. Thus, phonological processing and literacy skills developed very slowly over this time. In contrast, the gap between t2 and t3 was 6 months, and during this time, learners developed much faster. Since the nature of phonological processing skills were different at t2 (as described in chapter 5) and participants had better developed PA and RAN skills at t2 compared to t1, the longitudinal relations from t2 to t3 were also examined.

6.3.4.1 Longitudinal correlations between t2 phonological processing and t2 LRF and t3 literacy

The longitudinal correlations between the t2 predictors and the t3 literacy outcomes are presented in *Table 6-19* for the isiXhosa and isiZulu groups. For the full correlation matrix for all tasks and timepoints, readers are directed to the csv file online at https://osf.io/gmnws/.

The t2-t3 correlations were stronger than the t1-t2, and t1-t3 correlations, likely because there was less time between the two assessment points. LRF at t2 had strong to very strong correlations with t3 literacy (r = .60-.88). These correlations were similar for the isiXhosa and isiZulu groups except for the correlation with reading comprehension which was strong for the isiXhosa group (r = .60) and very strong for the isiZulu group (r = .75). T2 PA (r = .64-.86) and t2 alphanumeric RAN (r = .53-.76) had strong to very strong correlations with t3 literacy. Generally, these correlations were stronger for PA than alphanumeric RAN. T2 non-alphanumeric RAN had moderate correlations (r = .36-.56) with t3 literacy. The correlation was slightly larger for the isiZulu group, with the exception of English spelling which was stronger for the isiXhosa group. The t2 digit span tasks correlated weakly to moderately (r = .15-.50) with t3 literacy for the isiXhosa group and weakly to strongly (r = .17-.69) in the isiZulu group. The L1 digit span correlations were similar for both groups, but the correlations between t2 English digit span and t3 literacy were generally stronger for the isiZulu group, especially for English reading comprehension (r = .69 for the isiZulu group and r = .50 for the isiXhosa group). Another key difference was the correlation between t2 digit span and t3 LRF. The corelation was weak for the isiXhosa group (r = .15 for L1 and r = .17 for English) and moderate for the isiZulu group (r = .40 for L1 and r = .54 for English).

Table 6-19. Pearson correlations between t2 predictors and t3 reading and spelling outcomes

	t2 variables		**L1 LRF**	**PA**	**RAN Alpha**	**RAN Non-Alpha**	**L1 Digit Span**	**Eng Digit Span**
t3	**L1 LRF**	X	.78	.64	.67	.39	.15	.17
		Z	.81	.67	.70	.54	.40	.54
t3	**L1 Reading Fluency**	X	.88	.78	.76	.54	.36	.30
		Z	.79	.76	.71	.46	.34	.55
t3	**L1 Reading Comp.**	X	.82	.78	.60	.38	.42	.39
		Z	.79	.77	.72	.50	.41	.56
t3	**L1 Spelling**	X	.81	.75	.67	.37	.29	.20
		Z	.80	.82	.75	.55	.39	.56
t3	**Eng Reading Fluency**	X	.73	.65	.61	.49	.42	.28
		Z	.75	.78	.67	.48	.37	.60
t3	**Eng Reading Comp.**	X	.60	.64	.54	.35	.50	.50
		Z	.75	.86	.57	.49	.44	.69
t3	**Eng Spelling**	X	.65	.72	.54	.56	.44	.31
		Z	.65	.78	.53	.36	.27	.47

Notes: Correlations for the isiZulu group are shaded. LRF – Letter recognition fluency; PA – PA; RAN Alpha – Alphanumeric RAN; RAN Non-Alpha – Non-alphanumeric RAN.

6.3.4.2 Describing the path analyses: t2 predictors of t3 literacy

Path analysis models were used to determine the longitudinal relation between t2 phonological processing, t2 LRF and t3 literacy outcomes (reading fluency, spelling, reading comprehension). The number of variables used to measure the PA and RAN constructs at t2 were reduced using principal components analysis, as described in chapter 6. That is, PA was reduced to one language general component as the confirmatory factor analysis demonstrated a one factor model to best fit the data at t2. RAN was reduced into two components. The alphanumeric RAN component included RAN letters and RAN digits. The non-alphanumeric RAN component included L1 RAN objects, English RAN objects and English RAN colours. The observed digit span scores (transformed to z-scores) were used because the correlations within language differed for the isiXhosa and isiZulu groups, and NWR did not load sufficiently on the latent PWM factor at t2. In this analysis, t2 LRF (z-score) was a predictor along with the phonological processing skills. Reading fluency and reading comprehension components were calculated for t3 (described in 6.3.3.2). T3 LRF (z-score) was included as an outcome in all models. The spelling scores at t3 were converted to z-scores per language. Three models were fit to the data to examine reading fluency, spelling and reading comprehension. These outcomes were predicted by all the phonological processing skills. LRF at t3 was also included as an outcome and was predicted by all phonological processing skills at t2, except for English digit span. This ensured that the model could be identified, and model fit indices estimated. The outcome variables were specified to be correlated. All coefficients were allowed to be freely estimated within each group. The equality of constraints in the language groups was checked to determine if the relations (regressions and correlations) were the same for the isiXhosa and isiZulu groups. The model fit indices and coefficients are presented for each model below.

6.3.4.3 Start of grade 3 (t2) predictors of reading fluency at t3

The sixth model examined t2 predictors of t3 LRF and t3 reading fluency. The MGCFA where all parameters were freely estimated indicated good fit of this model to the data, scaled χ^2 (2) = 0.099, p = .952, scaling factor = 0.959, robust CFI = 1.000, robust TLI = 1.085, robust RMSEA = 0, SRMR = .002. The model where the regressions were constrained to be equal fit the data adequately and did not result in worse model fit, scaled χ^2 (19) = 19.235, p = .442, scaling factor = 1.031, robust CFI = 1.000, robust TLI = 0.999, robust RMSEA = 0.014, 95%CI [0; 0.109], SRMR = .029. Thus, the t2 predictors were similarly related to t3 reading fluency in each language group. The results of this model are presented in *Table 6-20* and visualised in *Figure 6-12*. Constraining the correlations among the outcomes resulted in worse model fit. The correlation between L1 and English reading fluency was stronger for the isiZulu group (r = .79) than the isiXhosa group (r = .48).

Table 6-20. Standardised coefficients of t2 predictors of t3 letter recognition and t3 reading fluency

	t3 LRF				t3 L1 Reading Fluency				t3 Eng Reading Fluency			
	isiXhosa		isiZulu		isiXhosa		isiZulu		isiXhosa		isiZulu	
Variables	**Β**	**p**	**β**	**p**	**Β**	**p**	**β**	**p**	**β**	**p**	**β**	**p**
t2 LRF	0.60	**.000**	0.60	**.000**	0.57	**.000**	0.53	**.000**	0.48	**.000**	0.44	**.000**
t2 PA	0.05	.519	0.06	.519	0.16	**.022**	0.19	**.022**	0.25	**.008**	0.28	**.008**
t2 RAN A.	0.20	**.038**	0.19	**.038**	0.19	**.023**	0.17	**.023**	0.07	.510	0.06	.510
t2 RAN NA.	0.06	.400	0.06	.400	-0.02	.790	-0.02	.790	0.06	.476	0.06	.476
t2 L1 DS	-0.03	.492	-0.04	.492	-0.03	.529	-0.04	.529	0.01	.879	0.01	.879
t2 Eng DS					0.08	.177	0.08	.177	0.06	.413	0.06	.413
R^2	0.675		0.670		0.755		0.707		0.638		0.664	

Notes: LRF – Letter recognition fluency; PA – phonological awareness; RAN A – Alphanumeric RAN; RAN NA – Non-alphanumeric RAN; DS – Digit span; p values less than .05 indicated in bold. In this model, regressions are constrained to be equal.

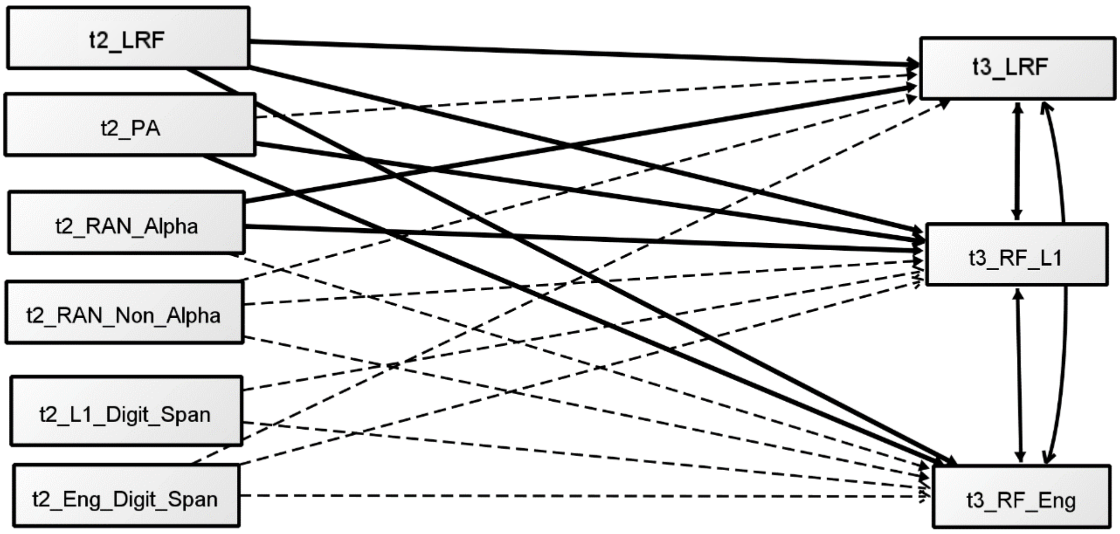


Figure 6-12. Path diagram of t2 predictors of t3 LRF and t3 reading fluency for the (a) isiXhosa and (b) isiZulu groups

At t3, LRF was predicted by t2 LRF (β = .60) and alphanumeric RAN (isiXhosa: β = .20; isiZulu: β = .19). T2 LRF predicted L1 reading fluency (isiXhosa: β = .57; isiZulu: β = .53) and English reading fluency (isiXhosa: β = .48; isiZulu: β = .44). Language general PA also predicted L1 reading fluency (isiXhosa: β = .16; isiZulu: β = .19) and English reading fluency (isiXhosa: β = .25; isiZulu: β = .28). Alphanumeric RAN predicted L1 reading fluency (isiXhosa: β = .19; isiZulu: β = .17), but not English reading fluency. The other t2 variables (non-alphanumeric RAN, digit span) were not significantly related to reading fluency at t3.

The variance accounted for by the t2 predictors for t3 reading fluency outcomes was very large, and all above 63%. The most variance was explained in L1 reading fluency (isiXhosa: 76%; isiZulu: 71%), and the variance explained for English reading fluency and LRF was similar. The variance explained in the t3 predictors by t2 predictors is larger than that explained by t1 predictors: the variance explained in L1 reading fluency for the isiXhosa group was 49% using t1 predictors and 76% using t2 predictors.

These results indicate that early literacy skill (LRF) measured at the start of grade 3 is the best predictor of literacy (reading fluency) at the end of grade 3. Language general PA made an additional contribution to reading fluency in both languages (slightly stronger for English), and alphanumeric RAN made an additional contribution to L1 letter reading fluency and text reading fluency. These t2 to t3 longitudinal relations were similar for the isiXhosa and isiZulu groups.

6.3.4.4 Start of grade 3 (t2) predictors of spelling at t3

The seventh model examined t2 predictors of t3 LRF and t3 spelling. The MGCFA where all parameters were freely estimated indicated good fit of this model to the data, scaled χ^2 (2) = 0.099, p = .952, scaling factor = 0.959, robust CFI = 1.000, robust TLI = 1.108, robust RMSEA = 0, SRMR = .002. Constraining the regressions and correlations to be equal resulted in worse model fit compared to the model where these were freely estimated, scaled χ^2 (22) = 33.703, p = .053, scaling factor = 1.031, robust CFI = 0.969, robust TLI = 0.941, robust RMSEA = 0.090, 95%CI [0; 0.128], SRMR = .040, $\Delta\chi^2$ = 33.379, Δdf = 20, p = .031. The results of the model with all parameters freely estimated are presented in *Table 6-21* and visualised in *Figure 6-13*.

Table 6-21. Standardised coefficients of t2 predictors of t3 letter recognition and spelling

	t3 LRF				**t3 L1 Spelling**				**t3 Eng Spelling**			
	isiXhosa		**isiZulu**		**isiXhosa**		**isiZulu**		**isiXhosa**		**isiZulu**	
Variables	**B**	**p**	**β**	**p**	**β**	**p**	**β**	**p**	**β**	**p**	**β**	**p**
t2 LRF	0.56	**.000**	0.62	**.000**	0.56	**.000**	0.25	.087	0.38	**.005**	0.24	.228
t2 PA	0.20	.113	-0.05	.656	0.36	**.001**	0.35	**.016**	0.42	**.001**	0.64	**.001**
t2 RAN A.	0.18	.171	0.22	.175	0.07	.570	0.30	**.028**	-0.31	**.010**	-0.07	.751
t2 RAN NA.	-0.02	.783	0.13	.257	-0.06	.438	0.03	.759	0.32	**.002**	-0.06	.764
t2 L1 DS	-0.13	.107	-0.06	.369	-0.01	.898	-0.07	.347	0.27	.121	-0.12	.276
t2 Eng DS					-0.06	.563	0.12	.091	-0.17	.318	0.06	.628
R^2	0.678		0.648		0.730		0.747		0.623		0.577	

Notes: LRF – Letter recognition fluency; PA – phonological awareness; RAN A – Alphanumeric RAN; RAN NA – Non-alphanumeric RAN; DS – Digit span; p values less than .05 indicated in bold. In this model, all parameters are freely estimated per group.

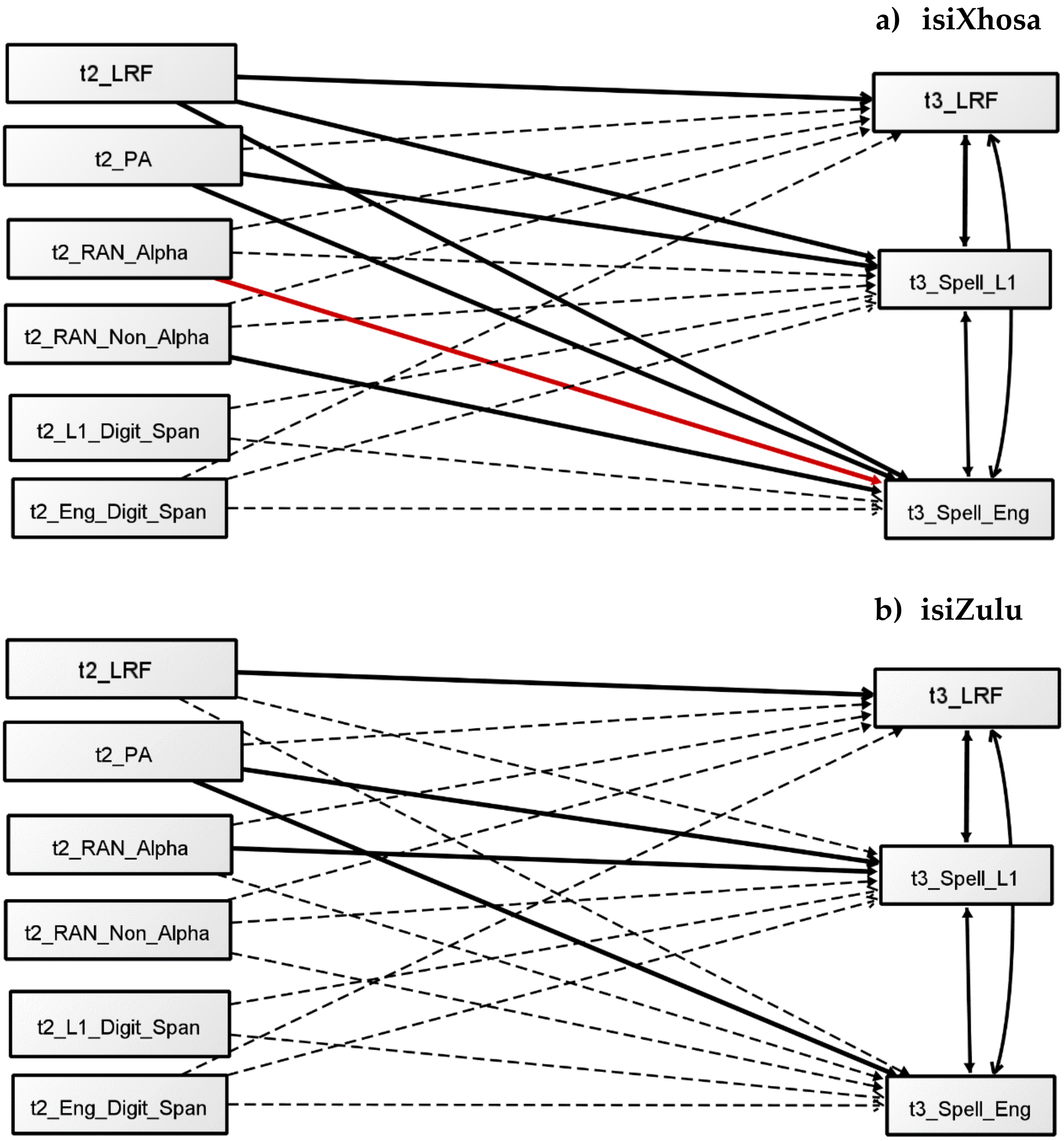


Figure 6-13. Path diagrams of t2 predictors of t3 LRF and t3 spelling for the (a) isiXhosa and (b) isiZulu groups

In this model where all parameters were freely estimated, only t2 letter sound recognition significantly predicted t3 letter sound recognition. The patterns of predictors and their strengths differed for the isiXhosa and isiZulu groups. Common for both groups is that language general PA was significantly related to L1 spelling and English spelling; the strength was similar for L1 spelling in each group (isiXhosa: β = .36; isiZulu: β = .35), but the isiZulu group had a larger effect size for English spelling (isiXhosa: β = .42; isiZulu: β = .64). Other than PA, the predictors of L1 spelling differed for each group. In the isiXhosa group, t2 LRF significantly predicted t3 L1 spelling (β = .56). In the isiZulu group, t2 alphanumeric RAN significantly predicted t3 L1 spelling (β = .30). The predictors of English spelling also differed. The only common predictor of t3 English spelling for the isiZulu group was PA. In the isiXhosa group, in addition to PA, t2 LRF (β = .38), alphanumeric RAN (β = -.31) and non-alphanumeric RAN (β = .32) were significantly related to t3 English spelling.

The t2 predictors accounted for a large proportion of variance in the outcomes. For L1 spelling, 73% and 75% of the variance was explained for the isiXhosa and isiZulu groups, which was similar to the variance explained for L1 reading fluency. For English spelling, 62% and 58% of the variance was explained by the isiXhosa and isiZulu groups. Thus, while the t2 predictors accounted for substantial variance in the outcomes, they better explained L1 compared to English spelling. PA was an important predictor for both groups, and the isiXhosa group relied also on their letter-sound knowledge.

6.3.4.5 Start of grade 3 (t2) predictors of reading comprehension at t3

The eighth model examined t2 predictors of t3 LRF and t3 reading comprehension. The MGCFA where all parameters were freely estimated indicated good fit of this model to the data, scaled χ^2 (2) = 0.099, p = .952, scaling factor = 0.959, robust CFI = 1.000, robust TLI = 1.110, robust RMSEA = 0, SRMR = .002. Constraining the regressions and correlations to be equal resulted in worse model fit compared to the model where these were freely estimated, scaled χ^2 (22) = 36.780, p = .025, scaling factor = 1.033, robust CFI = 0.960, robust TLI = 0.923, robust RMSEA = 0.101, 95%CI [0.036; 0.157], SRMR = .076, $\Delta\chi^2$ = 36.427, Δdf = 20, p = .014. The results of the model with all parameters freely estimated are presented in *Table 6-22* and visualised in *Figure 6-14*.

Table 6-22. Standardised coefficients of t2 predictors of t3 letter recognition and reading comprehension

	t3 LRF				**t3 L1 Reading Comprehension**				**t3 Eng Reading Comprehension**			
	isiXhosa		**isiZulu**		**isiXhosa**		**isiZulu**		**isiXhosa**		**isiZulu**	
Variables	**β**	**p**	**β**	**p**	**β**	**p**	**β**	**p**	**β**	**p**	**β**	**p**
t2 LRF	0.56	**.000**	0.62	**.000**	0.64	**.000**	0.40	**.009**	0.23	.273	0.31	**.043**
t2 PA	0.20	.113	-0.05	.656	0.34	**.015**	0.27	**.043**	0.15	.323	0.76	**.000**
t2 RAN A.	0.18	.171	0.22	.175	-0.11	.424	0.21	.172	0.22	.273	-0.24	.053
t2 RAN NA.	-0.02	.783	0.13	.257	-0.05	.378	0.01	.940	-0.12	.373	0.06	.524
t2 L1 DS	-0.13	.107	-0.06	.369	0.08	.290	-0.01	.955	0.32	.080	0.05	.703
t2 Eng DS					0.05	.482	0.04	.648	0.11	.590	-0.09	.287
R^2	0.679		0.648		0.736		0.681		0.504		0.748	

Notes: LRF – Letter recognition fluency; PA – phonological awareness; RAN A – Alphanumeric RAN; RAN NA – Non-alphanumeric RAN; DS – Digit span; p values less than .05 indicated in bold. In this model, all parameters are freely estimated per group.

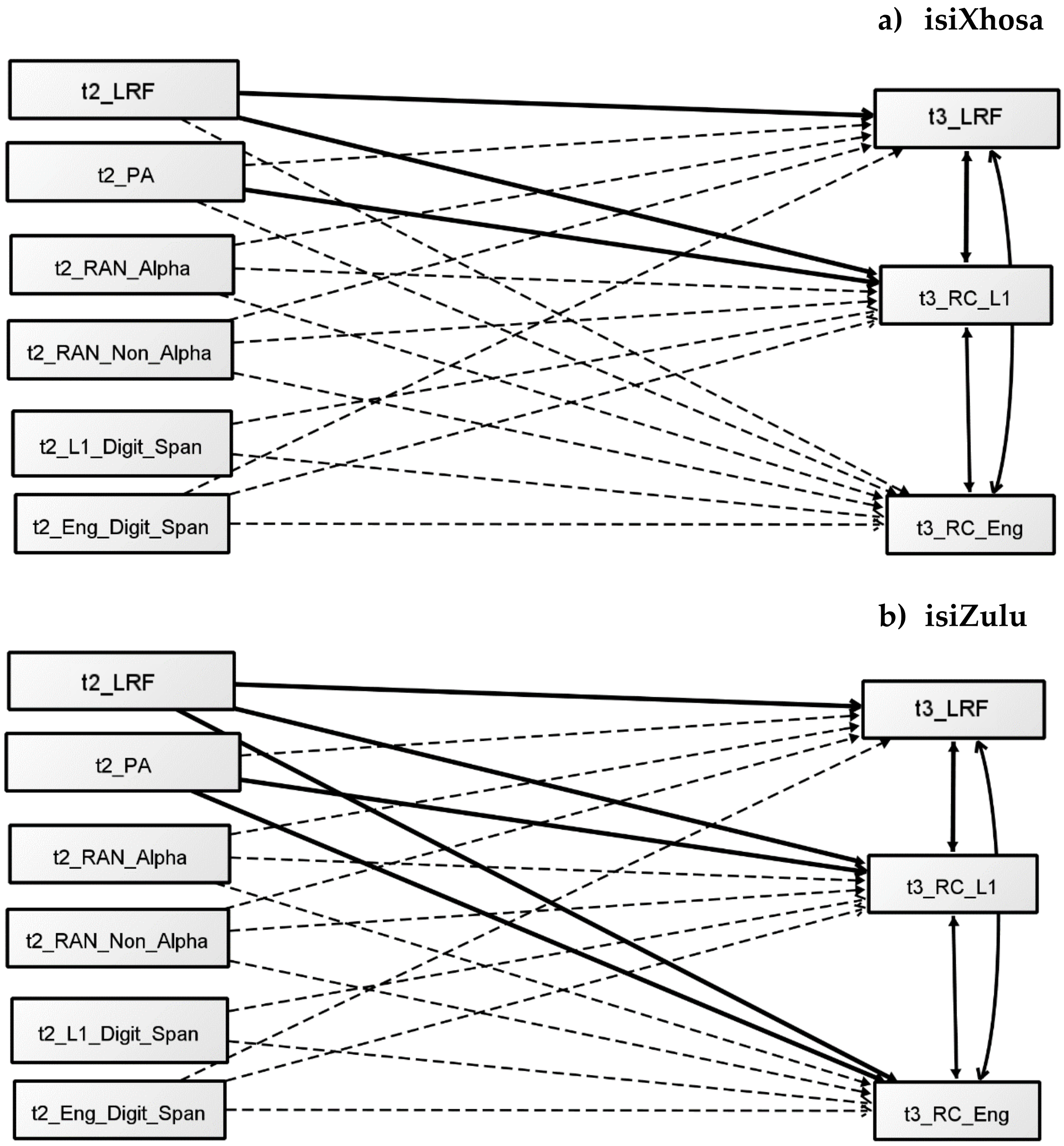


Figure 6-14. Path diagrams of t2 predictors of t3 LRF and t3 reading comprehension for the (a) isiXhosa and (b) isiZulu groups

The predictors of t3 LRF were addressed in the previous section and are not repeated here. The same variables significantly predicted L1 reading comprehension in both groups, but the strength of the associations differed. Both t2 LRF (isiXhosa: $\beta = .64$; isiZulu: $\beta = .40$) and language general PA (isiXhosa: $\beta = .34$; isiZulu: $\beta = .27$) predicted L1 reading comprehension. The associations were stronger for the isiXhosa group. None of the variables significantly predicted English reading comprehension in the isiXhosa group, which is a similar finding when t1 predictors were used. English reading comprehension in the isiZulu group was predicted by t2 LRF ($\beta = .31$) and t2 language general PA ($\beta = .76$).

The models accounted for a large proportion of the variance in reading comprehension. The proportion explained in L1 reading comprehension was similar for the isiXhosa (74%) and isiZulu (68%). These numbers are larger for the isiXhosa group (compared to when t1 measures were used as predictors), and similar for the isiZulu group. A large proportion of variance in English reading comprehension was explained for the isiZulu group (75%). While there were no significant predictors for the isiXhosa group, half the variance was accounted for.

6.3.4.6 Summary: path analyses of t2 predictors of t3 literacy outcomes

The t2 predictors explained a large proportion of variance in the outcomes, accounting for at least 50% and up to 75% in the variance. The t2 predictors overall explained more variance in t3 outcomes than did the t1 predictors. The predictors of reading fluency were equivalent in the two groups: LRF, PA, and alphanumeric RAN predicted L1 reading fluency, and letter recognition, and PA predicted English reading fluency. For spelling, PA was a significant predictor for both groups for L1 and English spelling. For the isiXhosa group, LRF predicted L1 and English spelling. Alphanumeric RAN negatively predicted English spelling, and non-alphanumeric RAN positively predicted English spelling. For the isiZulu group, alphanumeric RAN positively predicted L1 spelling. L1 reading comprehension was explained by the same predictors: LRF and PA. None of the measures significantly predicted English reading comprehension in the isiXhosa group. In the isiZulu group, LRF and PA significantly predicted reading comprehension. Common to all models where PA was a predictor, is that its association with the outcome was stronger in English than in the L1. With regards to group differences, the patterns of predictors were the same for L1 and English reading fluency, and L1 reading comprehension. The groups thus differed in the models explaining spelling and English reading comprehension. Generally, the isiXhosa group had stronger effects of LRF, and the isiZulu group had stronger effects of PA. LRF and PA at t2 were often predictors of literacy at t3.

6.4 CONCLUSION

In this chapter, I presented an overview of the literacy outcomes attained at t3, the final measurement point of the study. Overall, there was heterogeneity in the groups with some children still being non-readers, and some meeting the reading benchmarks for third grade. The isiXhosa and isiZulu groups attained similar final scores on the tasks with the exception of LRF, L1 word reading accuracy, L1 word reading fluency and L1 spelling, where there was a small to medium effect in favour of the isiXhosa group. The multilevel models examined whether the task scores improved over time, which they did with the exception of English blending, L1 RAN objects, and L1 digit span. The longitudinal path analyses with t1 predictors revealed that the longitudinal relations of t1 phonological processing and t1 vocabulary skills, with t2 and t3 literacy outcomes differed by language group. What was similar for both groups was that t1 LRF was related to later LRF, RAN digits was related to t2 reading fluency, and L1 digit span was related to L1 reading comprehension. The predictors of spelling were not consistent for both groups. The longitudinal path analyses with t2 predictors highlighted the importance of t2 LRF and t2 language general PA. The patterns of predictors in each group were the same for reading fluency and L1 reading comprehension. Similar to the t1 models, the patterns for spelling differed for each group. These findings are discussed with reference to the literature in the next chapter, chapter 7.

7 Chapter 7. Discussion and Conclusion

7.1 INTRODUCTION

This study examined the longitudinal relation between phonological processing and literacy skills for two groups of children who speak and are learning to read a closely related L1 (isiXhosa or isiZulu) and English (the additional language). The L1 was also the LoLT of the schools. As indicated in chapter 1, the main research question addressed in this study is: *What are the within-language and across-language causal relationships among phonological processing skills (PA, RAN, PWM) and reading and spelling in isiXhosa-English and isiZulu-English emergent bilingual children from grade 1 to grade 3?* Sub-questions explored the nature and direction of cross-language transfer among phonological processing skills, and whether the findings were the same for the isiXhosa and isiZulu groups. The final two sub-questions examined whether vocabulary was related to literacy skills after controlling for phonological processing skills and explored why (and to what extent) RAN is related to literacy.

Data for this study was collected when the participants were at the end of grade 1 (t1), at the start of grade 3 (t2) and at the end of grade 3 (t3). The COVID-19 pandemic affected the children's schooling in grade 2 (school closures) between t1 and t2, and grade 3 (rotational timetabling) between t2 and t3. Participants completed a battery of L1 and English phonological processing tests at t1 and t2, and L1 and English reading and spelling tests at t1, t2, and t3. Receptive vocabulary in L1 and English was also measured at t1 before phonological processing and literacy skills were assessed. Parallel tests were designed for isiXhosa and isiZulu to measure the same constructs as the standardized English tests. The tasks included in these tests included: PA tasks (blending, elision, isolation), RAN tasks (letters, digits, colours, objects), PWM tasks (digit span, NWR), receptive vocabulary tests (PPVT and its translation), reading tasks (LRF, isolated word reading, text reading, reading comprehension) and spelling tasks. In most case, each construct was measured by multiple tasks. Data reduction techniques were used in the data analysis to address the construct level rather than the task level.

To understand the longitudinal relationships among skills, one must first understand the nature of the relations cross-sectionally. These results were presented in chapter 4 (t1, grade 1) and chapter 5 (t2, start of grade 3). At t1 and t2, concurrent within and across-language relationships in the phonological processing constructs were examined using confirmatory factor analysis (CFA). CFA was used to determine the dimensionality of bilingual PA, bilingual RAN, and bilingual PWM, i.e., whether the tasks measured in L1, and English loaded on a language specific, or language general factor was examined. After establishing dimensionality, the relations between phonological processing and reading, and phonological processing and spelling were evaluated using path models. The relations in the isiXhosa and isiZulu groups were directly compared in the cross-sectional analysis.

The longitudinal analyses were presented in chapter 6. First, the descriptive statistics for t3 were reported to establish an understanding of the final attainment of literacy skills in the sample. Secondly, hierarchical linear models and figures were used to demonstrate how scores on the tasks changed over time. Finally, the main analysis presented path analysis models of the longitudinal relationships between t1 phonological processing skills, t1 vocabulary knowledge and t1 LRF predicting t2 and t3 literacy skills, and the longitudinal relationships between t2 phonological processing and t2 LRF predicting t3 literacy skills.

In this final chapter I discuss the research findings that were presented in chapter 4, chapter 5, and chapter 6. I have structured the discussion thematically, beginning with a discussion of the vocabulary scores in grade 1, then addressing the bilingual dimensionality of the phonological processing skills at t1 and t2, a discussion of the developmental trajectories of skills, and completing the discussion of results by referring to how phonological processing skills and vocabulary measured in grade 1 (t1) and the start of grade 3 (t2) were related to literacy concurrently and longitudinally. Finally, I address the limitations of the study and avenues for further research, and the theoretical and practical implications of the study, before concluding.

7.2 MAIN FINDINGS

7.2.1 Varied receptive vocabulary in L1 and L2 in grade 1

In chapter 2 it was established that oral language knowledge forms the foundation on which literacy is developed. This is because learning how to read and spell is based on mapping oral language to written language and understanding what one reads relies on knowing what words mean. In the sections that follow, I discuss the vocabulary scores children had in grade 1 and how L1 and English vocabulary were related.

7.2.1.1 Children come to school with varying levels of vocabulary knowledge in their L1 and L2

There is an explicit statement in the English FAL curriculum document that "children come to school knowing their home language" (Department of Basic Education, 2011b, p. 8). However, in line with international and national research (Christensen et al., 2014; Hemphill & Tivnan, 2008; Makaure, 2021; Song et al., 2015; Tredoux et al., 2022; Wilsenach, 2015) my research indicates that vocabulary knowledge, even in L1, varies between children when they start school. In the middle of grade 1, children's scores on the vocabulary tests varied within and between the language groups and reflected the order of acquisition and language exposure the groups received in their homes and communities.

A parent questionnaire completed by caregivers of half the participants confirmed that the isiZulu group of participants were exposed to more languages via their caregivers and communities. isiZulu caregivers on average reported being able to productively use three languages and reported that their children could productively use approximately two languages. For the isiXhosa group, these values were two and one. This insight into the language exposure of children may explain why the isiXhosa group (M = 73, SD = 16), had a higher average L1 vocabulary raw score compared to the isiZulu group (M = 59, SD = 17), and the isiZulu group (M = 32, SD = 14) had a higher English raw score than the isiXhosa group (M = 25, SD = 12) on average. These represented large and medium effects, respectively. The minimum and maximum scores for L1 vocabulary were quite similar between the two groups ranging from around 20 to 90. However, for English, the gap between the lowest and highest score was 60 raw points, with the isiXhosa group having lower minimum (3 vs 10) and maximum values (64 vs 72) than the isiZulu group. On average, there was a very large effect size demonstrating that participants knew more words in their L1 than English, which is expected, given that they are sequential emergent bilinguals.

Vocabulary and emergent literacy skills can also be developed through shared book reading (Dowdall et al., 2017), but shared book reading was not common at home for this sample. Sixty percent of the homes did not have children's books in them, according to the caregiver questionnaire, and caregivers reported never reading a book to their child in half the isiXhosa homes and a third of the isiZulu homes. Thus, it appeared that children's language was developed through oral exposure at home and in communities, and not from storybooks, which in English, tend to have less frequent and more varied vocabulary (Nation, 2006; Stoffelsma, 2019a). More research is needed to understand how book exposure contributes to vocabulary development in African languages (Wilsenach & Schaefer, 2022).

In summary, children come to school with varied oral language ability, based on individual differences in the rate of vocabulary development, and home and community exposure. It would be an oversimplification to assume that all children come to school with well-developed vocabulary skills in their home language (L1).

7.2.1.2 L1 and L2 receptive vocabulary are weakly correlated

In this study, L1 and L2 vocabulary were weakly correlated for the isiXhosa (r = .21) and the isiZulu (r = .28) groups. These correlations are higher than that reported in a meta-analysis (Melby-Lervåg & Lervåg, 2011) of the L1-L2 oral language correlation (r = .16, 95% CI [.07, .24]) among different languages although there was significant heterogeneity in the effect size which the moderators could not account for. Inspection of the effect sizes in the meta-analysis of Melby-Lervåg & Lervåg (2011) showed that the correlation was negative in some included studies and positive in others, and the study only included studies where children were exposed to both languages at home, or were exposed to both languages at school for more than four hours a day. Thus, the weighted average effect calculated by Melby-Lervåg & Lervåg (2011) may not be applicable for the context of the current study where three hours of English instruction are provided per week at school according to the curriculum and caregivers report using predominantly L1 at home.

The L1-L2 vocabulary correlation in my study are also weaker than what has been found for other Southern African studies which included receptive vocabulary measures. African research has found slightly higher L1-L2 correlations in grade 1 of r = .43 (Northern Sotho-English: Wilsenach, 2015) and r = .43 (Kiswahili-English: Wawire & Zuilkowski, 2020), and grade 2 of r = .33 (Northern Sotho-English, Northern Sotho instruction: Makaure, 2021) and r = .45 (Northern Sotho-English, English instruction: Makaure, 2021). As well as not having high English exposure at home, vocabulary is not always instructed explicitly in South African classrooms (J. Sibanda & Baxen, 2018; Stoffelsma, 2019b). These above-mentioned correlations may be stronger in these studies compared to mine because children received more English instruction. L1-L2 vocabulary correlations are stronger in contexts where the L2 is instructed. The relationship between receptive vocabulary and literacy skills will be discussed in section 7.2.4.5 of this chapter.

7.2.2 The nature of PA, RAN, and PWM in isiXhosa-English and isiZulu-English emergent bilingual children

In this study, Cummins (1979) interdependence hypothesis was used to consider cross-language transfer. This hypothesis suggests that skills in one language can be used to build skills in another language given sufficient instruction and motivation to learn the new language. Cummins also proposed a common underlying proficiency which makes this transfer possible (Cummins, 2017; Geva & Ryan, 1993). To complement this view, the central processing hypothesis proposes that the same skills underlie and are utilised in reading in different languages (Geva & Siegel, 2000), which may be affected by the orthographic depth of each language (orthographic depth hypothesis (L. Katz & Frost, 1992)). Thus, before examining how phonological skills (PA, PWM and RAN) are related to literacy skills, a first step in the analysis was determining whether these phonological processing skills arose from language specific or language general abilities, and whether the findings were the same for the isiXhosa and isiZulu groups. Multi-group confirmatory factor analysis models at t1 and t2 per construct were used to explore this question.

7.2.2.1 The nature of bilingual PA

In the present study, latent PA was best conceptualised as highly correlated language specific factors in first grade (chapter 4), but as one latent language general PA factor at the start of third grade (chapter 5). The results were the same for the isiXhosa and isiZulu groups. These results reflect that PA skill is dependent on language characteristics (Ziegler & Goswami, 2005) and task characteristics (Lonigan et al., 2009), and could reflect developmental changes in the nature of bilingual PA.

Firstly, isiXhosa and isiZulu have simple consonant-vowel syllable structures, whereas English has consonant clusters both in onset and coda position, as described in chapter 3. These language differences were considered in the PA items included in the isiXhosa/isiZulu adaptation of the CTOPP. As described in chapter 3, the CTOPP includes items at the word, onset-rime, and phoneme levels (including consonants in consonant clusters in word initial and final position) in English. In contrast, the isiXhosa and isiZulu items included syllable and phoneme level tasks only. Thus, while the L1 PA tests were developed to be similar to the English test, the tasks captured some language specific information.

The extent to which PA scores were affected by the specific task was examined by including correlated residuals for the same task in each language, as had been done by Branum-Martin et al. (2015). Task effects on bilingual performance were also more pronounced in first compared to third grade; that is, the correlated residuals were higher in first compared to third grade. This result indicates that in first grade, the type of task plays more of a role in the final PA score, but in third grade, this influence is decreased. Thus, as children get older, they become more adept at manipulating the sounds in words, in either language.

A language-specific to language general representation of PA could reflect developmental changes in PA influenced by oral language proficiency and phonological representations in the L2. Saiegh-Haddad (2019) argues that L2 PA relies on both language general metacognitive knowledge (i.e., that words can be broken into sounds) and language specific phonological representations. Phonological representations are influenced by the structural differences between L1 and L2, and oral language proficiency in the L2. That is, the extent to which L2 PA can be considered language specific is influenced by how different the phonological representations are in the L2, compared to L1, and how well L2 phonological representations are stored in long term memory. In the case of isiXhosa/isiZulu and English, the need to manipulate consonants in clusters and word final consonants is specific to English as isiXhosa and isiZulu uses simple consonant-vowel syllables. Phonological representations of L2 words in long term memory may also be weaker at early stages of learning the L2. Thus, the results from my study suggest that the linguistic differences between L1 and L2, and lower English vocabulary knowledge at t1, contributed to PA being language specific. That PA was conceptualised as language general in this sample at t2 (start of grade 3) may reflect more developed phonological representations which were available independently of the language of the task.

In summary, PA ability in L1 and English is highly correlated and may represent a common underlying proficiency for readers of alphabetic scripts (Gottardo et al., 2021), supporting the findings of Branum-Martin et al. (2015). These results support the central processing hypothesis (Geva & Siegel, 2000), in that bilingual PA was highly correlated in grade 1, and loaded on the same factor in grade 3, indicating that much of the variance in these skills was shared. However, since the skills did not overlap completely in first grade, the results also suggest that differences in the phonological structure of a bilingual's languages can affect the extent to which PA in the L1 and L2 are similar (Saiegh-Haddad, 2019).

7.2.2.2 The nature of bilingual RAN

In this study, RAN was best conceptualised as a language general construct or a underlying cognitive process (Gottardo et al., 2021) consisting of alphanumeric (letters and digits) and non-alphanumeric (objects and colours) factors which had the same factor loadings for each language group. These results add to existing research which found RAN to load on two factors (e.g., Gordon et al., 2021; Papadopoulos et al., 2016; van den Bos et al. 2002). Furthermore, RAN tasks tap an underlying cognitive process, as argued by Georgiou et al. (2022), that can be applied in different languages. My study further adds that the particular social and educational context of the participants should be considered when selecting RAN tasks, mentioned also by Makaure (2021). Thus, while RAN tasks may tap a language general or underlying RAN ability, some consideration must be given to determining which items are automatically recognised by the particular bilingual sample.

Both the pilot study and the main study provided evidence for the influence of instruction and language exposure on RAN. The pilot study found that children were not familiar with colours and digits in L1, which I explained was due to the social and educational context where English is predominantly used for these concepts. The exception was isiXhosa participants who could reliably name the colours *red* and *blue* in isiXhosa. Furthermore, the RAN letter task was administered only in L1 because many letter sound correspondences overlap in L1 and English. Thus, in the main study, letters and objects were assessed in L1, and digits, objects and colours were assessed in English.

In the main study, there were two examples of how instruction and language exposure affected bilingual RAN. Firstly, letter naming was not yet automatic for the sample in first grade; half the sample were not sufficiently familiar with letters so they could not complete the task. A lack of familiarity with letters has been identified as a constraint when working with younger samples (McWeeny et al., 2022), but usually applies to Kindergarten samples. In the South African case, grapheme-phoneme instruction may not be systematically provided, and children begin school with little knowledge of letters (Pretorius et al., 2022; Wills, Ardington, & Sebaeng, 2022). Importantly, the RAN digits task, which was administered in English, elicited similar naming speeds for both groups of children. These findings confirm the conclusion of Gottardo et al. (2021) that RAN digits measured in the language these digits are instructed in and which children are familiar with is a reliable indicator of alphanumeric RAN. My study also demonstrated that digit naming automaticity develops before letter naming and can be effectively used in contexts where children are not yet reading.

Secondly, the isiXhosa group had persistently slower naming times for English colours and objects at t1 and t2 because they were less exposed to English in their home and school community compared to the isiZulu group. The correlations between English RAN objects and literacy were very weak for the isiXhosa group ($r < .27$) but weak to moderate in the isiZulu group (.27 - .46) at both timepoints. However, the correlations between colours and literacy tasks did not differ dramatically for English RAN colours. That the isiXhosa group was slower overall in colour naming may be explained by their lower familiarity with some of the colours; many children would say *bomvu*, then self-correct to *red*. This reflects their category specific exposure to colour names in isiXhosa and English (Moraleda et al., 2022), while the isiZulu group used mostly English to name the colours. Because the colours are lexicalised predominantly in English, it could explain why the colour naming task had similar correlations with literacy in both groups. On the other hand, the object naming task was affected by semantic or vocabulary knowledge of English because the phonological representation of whole lexical units had to be retrieved (Vander Stappen & Van Reybroeck, 2018). The semantic access involved in object naming is used to explain why this task is more weakly related to literacy outcomes (Åvall et al., 2019). The results from my study are consistent with Makaure (2021) who found that the Northern Sotho LoLT group had faster Northern Sotho object naming, but slower naming of English objects compared to the English LoLT group. Thus, non-alphanumeric tasks also capture some additional information, such as semantic knowledge, that is not just a measure of RAN, and is therefore affected by language exposure (Moraleda et al., 2022). I, therefore, would caution against using benchmarks for non-alphanumeric RAN, specifically object naming, for different bi- or multi-lingual samples.

7.2.2.3 *The nature of bilingual PWM*

With regards to bilingual PWM, the confirmatory factor analysis also supported a language general task general model. A language general task specific model fit the data at t2 for the whole sample, but the model did not fit both language groups. Thus, the language and task general model of PWM was preferred, according to the CFA. However, the loadings for NWR on the general PWM factor were low, and the correlation between NWR and reading skills was very weak to moderate ($r < .40$), and often weaker than digit span. Additionally, the correlations between digit span and literacy skills cross-linguistically were often stronger in the language that the group knew better: L1 digit span was a better measure of PWM for the isiXhosa group, and English digit span was a better measure of PWM for the isiZulu group.

NWR was not a good indicator of PWM in this sample. The factor loadings for NWR on the PWM latent factor were low, so the NWR scores were not included in the main analyses. Makaure (2021)[32] also found unexpected patterns in the NWR data, which were explained to be due to contextual extraneous factors. While the NWR tasks had acceptable internal reliability in my study (chapter 3), I am not satisfied that these are reliable tasks for this context for a number of reasons. Firstly, the tasks were administered by different assistants at t1, and at t2. I trained the assistants before starting fieldwork and provided corrective feedback after listening to the audio recordings. Nevertheless, the change in data collectors is a source of variation, in terms of how the scoring was done. Secondly, the environment in which data was collected was very noisy, especially at t2. Environmental noise can affect the data in two ways. Noise could have affected what participants heard and noise could have affected how accurately the data collectors could score the results, especially because the protocol requires that the stimulus and response be said once only. There was more background noise at t2, when children went out on break in rotation so that at almost any point after 10am, there were children on break outside the classroom. These environmental influences on noise could not be controlled. Lastly, as described in chapter 3 and mentioned by Makaure (2021), the American pronunciation of prompts may also have affected the English NWR scores.

7.2.3 The longitudinal development of phonological processing and literacy skills

Before addressing how phonological processing skills were predictive of literacy skills longitudinally, it is important to understand how the scores for each task developed over time. Multilevel models were fit to the t1 and t2 data for phonological processing and spelling tasks, and to t1 to t3 for the reading tasks. The p values were Bonferroni corrected per construct to reduce Type 1 errors (reporting a significant effect when there is no such effect in the population) because all the models relating to the same

[32] At the time of my data collection, the results of Makaure (2021) were not yet available.

construct were related to one another. This statistical correction has been termed very conservative, however.

Using the conventional $p < .05$ level, all scores on the phonological processing and literacy tasks improved over time. This result demonstrates how children's capacity for these tasks improves over time with development. However, after correcting for multiple comparisons within each construct, the main effect of time was non-significant for the English blending, L1 RAN objects and L1 digit span tasks. That is, the scores of these tasks did not improve considerably between the end of grade 1 (t1) and the start of grade 3 (t2). The lack of growth should be considered to be specific to the language the task was measured in as the corresponding tasks in the L1 or in English did improve over time.

7.2.3.1 Considering why English blending, L1 RAN objects, and L1 digit span scores did not improve over time

With regards to English blending, I suggest this finding is due to the interference of the American accent used in the CTOPP recordings, as discussed also by Makaure (2021)[33]. While the English elision and isolation tasks also use this accent, whole words are presented, making it easier for children to match the word to their own phonological representation of the word. However, in the blending task, parts of words are presented. Anecdotally, in my own observation of participants, children at t1 were able to blend the sounds together into the (American sounding) word and did not seem to know that the resulting word was an English word. At t2, children seemed to try to identify which English word in their lexicon the sounds represented. Since the words sound so different to their own representation of these words, the children responded incorrectly. I use blending *hammer* as an example. In the American recording, rhoticity is included, and the syllabification of the word is different: [hæm.ɚ][34]. Thus, scores may have remained stagnant for English blending because children understood the task better and, therefore, tried to search their mental lexicon for the phonological representation which did not exist in that accent, thereby providing no answer or an incorrect answer. Since L1 blending improved, the lack of growth in scores for English are likely not because phonological blending skills did not improve per se. Importantly, the growth in PA scores was the same for the isiXhosa and isiZulu groups even though they had different language and literacy exposure.

The lack of significant improvement in L1 RAN objects and L1 digit span is likely due to the participants estimated increased exposure to English over time. In

[33] At the time of my data collection, the results of Makaure (2021) were not yet available.

[34] Participants would pronounce this word as [ɦe.mə].

my study, it is possible that children increased their use of English to name the items in the RAN objects task which included *sun*, *dog*, *table*, *star*, *hand,* and *book* in L1 and *pencil*, *star*, *fish*, *chair*, *boat*, and *key* in English. Thus, there was only a small effect size in favour of L1 naming, and L1 naming improved less over time, because children may have been more exposed to these object words in English as they proceeded in their education. Furthermore, it is expected that English digit names were used more extensively as the children progressed through school.

7.2.3.2 Explicit L1 phoneme-grapheme instruction may improve L1 reading fluency trajectories and L1 spelling accuracy

Instruction may affect the rate of growth of reading skills. In studies of English reading development, the rate of growth of reading fits a quadratic trend with initial rapid development followed by deceleration from around fourth grade (e.g., Jimerson et al., 2013; Parrila & Kirby, 2005). This quadratic trend is also found for Setswana, but only for children who can automatically recognise at least five letters correctly in a LRF task (Wills, Ardington, & Sebaeng, 2022). The trajectory for children who end first grade with zero scores on automatic letter recognition (Wills, Ardington, & Sebaeng, 2022) is the same as what was found in my study: between t1 and t2, the rate of growth in reading fluency was flat and very slow, with faster growth between t2 and t3. Growth in L1 reading was steeper for the isiXhosa group as evidenced by a significant group by time interaction in the multilevel models, and a small effect size difference in the final reading fluency score at t3. The English reading trajectories did not differ significantly between the groups, however. The spelling task changed over time, so the multilevel model was not used to examine growth in spelling from t1 to t3. Examining only the t3 spelling result means, the isiXhosa group had higher L1 spelling (but not English spelling) scores than the isiZulu group, which represented a medium effect size.

To understand these reading trajectories, and the final attainment of L1 reading and spelling scores and why they may differ for the language groups, one must consider the similarities and differences between the isiXhosa and isiZulu groups. Firstly, the groups were quite similar in terms of their economic status (reported in chapter 3). Secondly, the groups did not differ in their scores in the PA tasks, and rapid digit naming, which are foundational skills related to reading. That group mean differences arose in t3 L1 reading and spelling but not English, therefore, potentially highlights differences in how L1 reading was taught in each group.

Although every effort was made to establish that the participating schools were similar, I discovered at t2 that the isiXhosa school was participating in the Funda Wande intervention. The Funda Wande intervention in the Eastern Cape provides teacher coaching, structured lesson plans and books to use in the classroom to support systematic L1 literacy instruction (Ardington & Meiring, 2020). It is possible that this intervention may have contributed to the group mean differences observed for L1 LRF, L1 word reading accuracy, and L1 spelling. I did not observe teaching, review teaching resources, nor did I interview teachers. These data sources would provide evidence for differences in teaching methods, and available resources. Thus, the following discussion is speculative, based on evaluations of Funda Wande in general, and my anecdotal observations during data collection.

The systematic instruction provided as part of Funda Wande may explain why the isiXhosa group outperformed the isiZulu group in L1 LRF, L1 word reading accuracy, and L1 spelling by the end of grade 3. The midline evaluation of Funda Wande found the program to be effective in improving L1 reading fluency (Ardington & Meiring, 2020). Thus, I speculate that the explicit L1 literacy instruction could have boosted the acquisition of phoneme-grapheme correspondence knowledge which the isiXhosa group was able to use in their reading and spelling. Importantly, the group that I estimate received more systematic L1 instruction did not read less fluently in English; there was no transfer of these phonics skills to English. The advantages in L1 reading accuracy, nevertheless, did not result in better reading comprehension skills in the isiXhosa group. These two points are addressed below.

Firstly, these results indicate no negative effect of L1 instruction for the isiXhosa group, and no advantages for more exposure to English for the isiZulu group. These results replicate what has been found in the first and second early grade reading studies (Cilliers et al., 2022; Taylor et al., 2017). Thus, L1 reading ability does not necessarily transfer to English reading ability automatically, especially when the orthographies differ in consistency. This finding highlights that explicit instruction in English phoneme-grapheme and larger grain sizes is necessary because of the inconsistent orthography of English (Ziegler & Goswami, 2005). Secondly, children struggled with reading comprehension, even when they had (relative) strengths in reading accuracy. At the end of grade 3, almost half the children in both language groups scored zero on the reading comprehension tasks. This may be indicative of the overall low levels of reading fluency. As per the automaticity hypothesis of LaBerge and Samuels (1974), when too much focus is placed on lower-level processes, such as trying to recognise words, there is insufficient working memory capacity to integrate the information in the text to support reading comprehension. Low reading comprehension scores are to be expected in this sample since 87% fall below the reading fluency benchmark of 35 cwpm for grade 3, and therefore are unlikely to be able to understand what they read. This finding also supports the Simple View of Reading (Hoover & Gough, 1990) where both decoding and oral language abilities are related to reading comprehension.

An alternative explanation for differences in final attainment of L1 reading accuracy and spelling is that the isiXhosa group performed better on these tasks because they had larger L1 vocabularies. Vocabulary supports eventual automatic word recognition, as existing word knowledge supports the representation of the word's orthographic and phonological form (Ehri, 2020). This alternate explanation is complementary to explicit phonics instruction since the isiZulu group had larger English vocabularies than the isiXhosa group, but no advantage in English reading or spelling accuracy. Thus, explicit instruction in grapheme-phoneme correspondences is necessary to utilise existing word knowledge, especially for an inconsistently written language such as English.

7.2.4 Concurrent and longitudinal predictors of literacy skills

Path analysis models were fit to the data to examine concurrent (cross-sectional) relations at t1 (chapter 4) and t2 (chapter 5), and to examine longitudinal relations from t1 to t2, t1 to t3, and t2 to t3 (chapter 6). Overall, the cross-sectional results revealed that LRF, PA, RAN digits, and vocabulary (t1 only) are significantly related to literacy skills at t1 and t2, and the pattern of these relations are, for the most part, similar for the isiXhosa and isiZulu groups. The longitudinal models which included t1 predictors revealed a less clear pattern, which differed for the isiXhosa and isiZulu groups. Notably, L1 vocabulary for both groups, and L1 and English PA for the isiXhosa group were not longitudinally related to any of the literacy outcomes. L1 digit span at t1 was longitudinally related to L1 reading comprehension for both groups and was a significant predictor for different outcomes in each group. The t2 to t3 longitudinal relations were much clearer: t2 LRF and PA were significant predictors of almost all outcomes. Alphanumeric RAN at t2 was a significant predictor of L1 reading fluency. The patterns of predictors were the same for each group for L1 and English reading fluency and L1 reading comprehension but differed for spelling, and English reading comprehension. These concurrent and longitudinal results are discussed per predictor in the sections below.

7.2.4.1 The role of LRF

L1 graphic symbol knowledge (LRF) supported L1 and English reading and spelling independently from PA. Graphic symbol knowledge, which was operationalised as LRF measured in L1 in this study, had significant direct effects on reading fluency and spelling in L1 and English cross sectionally. These concurrent (cross-sectional) effects of LRF on literacy outcomes were stronger for L1 reading fluency than English reading fluency at both t1 and t2. The effect on reading fluency was smaller at t2 than t1 for L1 but remained of similar magnitude for English. The effect of LRF on spelling was stronger for L1 spelling than English spelling at t1, and of similar magnitude at t2 for both languages. In the longitudinal analysis which included t1 predictors, t1 LRF had different longitudinal relations for the isiXhosa and isiZulu groups. For the isiXhosa group, t1 LRF was significantly related to LRF and spelling in L1 only at t2 and t3, and L1 reading comprehension at t3. For the isiZulu group, t1 LRF was significantly related to t2 LRF, t2 English reading fluency, t2 L1 spelling, and t3 L1 reading fluency after controlling for phonological processing skills and vocabulary. In the longitudinal analysis which included t2 predictors, t2 LRF predicted t3 LRF, L1 and English reading fluency and L1 reading comprehension for both groups. T2 LRF predicted t3 spelling only for the isiXhosa group, and t2 LRF predicted English reading comprehension only for the isiZulu group. The associations were stronger for L1 than English outcomes for the t2 to t3 longitudinal relations. Thus, LRF was a strong concurrent predictor within and across-language for the isiXhosa and isiZulu group. Longitudinally, LRF was a consistent predictor of t3 literacy, when measured at t2 rather than t1. The t1 predictive relations were less consistent and differed by group, whereas the t2 to t3 relations were the same for reading fluency and L1 reading comprehension.

The cross-sectional findings highlight the importance of well-established grapheme-phoneme correspondence knowledge for reading and spelling cross-linguistically (Landerl et al., 2022). While there is a lot of overlap in the grapheme-phoneme correspondences in isiXhosa/isiZulu and English, there are still many orthography specific correspondences that emergent bilingual/biliterate children will need to learn. For example, the complexity in learning grapheme-phoneme correspondence knowledge in isiXhosa and isiZulu is that there are many more phonemes that need to be represented than there are letters, so multiple letters have to be used to represent these sounds, e.g., *hl*, *dl*, *ntsh* (J. Katz & Rees, 2022). Thus, although the orthography of isiXhosa and isiZulu are consistent, there are still many grapheme-phoneme correspondences to learn, albeit at a small grain size. On the other hand, the complexity in English, comes from the inconsistency at the small grain size, so novice readers need to learn many orthography-phonology mappings at different grain sizes (Ziegler & Goswami, 2005). For bilinguals, additional complexity is introduced because the grapheme-phoneme correspondences are language specific, e.g., [i:] is represented as *i* in isiXhosa/isiZulu but with *ee*, *ea* or *ey* in English, which could explain the common spelling error at t3 where *sheep* was written as *ship*. These differences explain why the LRF task (which used some L1 specific letter groups) had larger effects on L1 reading and spelling than English reading and spelling for the most part.

The concurrent (cross-sectional) effect of LRF on L1 reading was slightly smaller at t2 than t1, and of similar magnitude at t1 and t2 for English. For spelling, the relations were of similar magnitude for L1 spelling at t1 and t2 and were larger at t2 than t1 for English spelling. It would be expected that the effect of letter knowledge on reading and spelling would decrease over time since letter knowledge is a constrained skill which can be mastered (Anthony et al., 2021), and because children build their orthographic lexicon and switch to larger grain sizes (Ehri, 2020; Ziegler & Goswami, 2005). This pattern of decreasing importance of LRF was only partially supported in this study. A consistent effect of LRF on reading fluency and spelling at t1 and t2 cross-sectionally could be explained by two possible reasons which are not mutually exclusive. Firstly, the rate of literacy development was slow in this sample on average. The persistent effect of letter knowledge on reading and spelling could reflect this level of development, where letter recognition, reading and spelling have not yet been automatised. Secondly, the graphic knowledge task in this study was a timed measure which will continue to have variation in scores, even after high levels of accuracy are reached. An accuracy measure may have ceased to be predictive of reading fluency and spelling once children became accurate letter readers. Another interpretation is to argue that the LRF task is a variation of a RAN letters task, given that the only difference between the tasks is the number of repeated items. I return to this point in section 7.2.4.3, when I discuss RAN.

LRF measured at the end of grade 1 was not a consistent longitudinal predictor of literacy outcomes at the start and end of grade 3, after controlling for phonological processing and vocabulary. For the isiXhosa group, t1 LRF was related to later LRF, L1 spelling, and reading comprehension. However, for the isiZulu group, most of the significant associations were with t2 outcomes (LRF, English reading fluency, L1 spelling), and t3 English reading fluency. These longitudinal results should be interpreted with reference to the mean scores at each time point. At t2 and t3, the isiXhosa group had higher mean scores on the L1 reading tasks than the isiZulu group. On average, the isiXhosa group were further along in their L1 reading development at t2 and t3. Thus, these results indicate that LRF measured at the end of grade 1 predicts a range of literacy skills after controlling for phonological processing and vocabulary. LRF measured at t1 is likely to reflect both home literacy environment and quality of instruction in the first half of grade 1 (O' Carroll, 2011; Wills, Ardington, & Sebaeng, 2022). Thus, not finding a consistent longitudinal association between t1 LRF and later reading could be indicative of the role of teaching, i.e., that children could improve their initial performance, and/or the influence of the pandemic, where lack of instruction during 2020 could have influenced the association between t1 and later reading/spelling. Thus, individual differences (such as PWM and RAN) which are less amenable to instruction may better explain later literacy outcomes when there is a long gap between assessment points. This explanation for the observed pattern of results is returned to in section 7.2.4.4 when discussing the role of PWM. A complementary explanation is that the longitudinal association between t1 LRF and later L1 spelling suggests that the isiXhosa group successfully used a smaller grain size for spelling (Probert & De Vos, 2016), compared to the isiZulu group. A lack of association with most English outcomes when using t1 predictors suggests that this letter-sound correspondence knowledge is language specific, thereby supporting the orthographic depth hypothesis (L. Katz & Frost, 1992), and the cross-sectional findings where LRF had smaller associations with English literacy outcomes in the path models.

In contrast to the t1 to t2 and t1 to t3 models, t2 LRF was a strong and consistent predictor of later literacy. T2 LRF predicted t3 L1 reading fluency, English reading fluency and L1 reading comprehension in both groups. It also predicted L1 and English spelling for the isiXhosa group, and English reading comprehension for the isiZulu group. Children had better LRF scores at t2 (isiXhosa: 38.1; isiZulu: 28.5) compared to t1 (isiXhosa: 15.5; isiZulu: 13), and the isiXhosa group had higher scores on average, representing a medium effect size. At t3, the isiXhosa group had better spelling scores than the isiZulu group, but they did not differ on reading fluency nor reading comprehension. These patterns in the descriptive statistics support the longitudinal results where the pattern of predictors was the same for reading fluency. With regards to spelling, the isiXhosa group had more automatised letter-sound knowledge at t2, which they used to their advantage in the spelling tasks at t3, whereas the isiZulu group relied more on their PA skills. Thus, these longitudinal results highlight the importance of supporting the development of letter-sound correspondence knowledge, even in consistent orthographies.

7.2.4.2 The role of PA

Overall, PA was a strong predictor of L1 and English reading fluency and spelling concurrently (cross-sectionally). Longitudinally, t1 PA was not a consistent predictor of later literacy outcomes, possibly because PA was not yet well developed in grade 1. However, t2 PA predicted t3 L1 and English reading fluency, L1 and English spelling, and L1 reading comprehension in both groups. T2 PA also predicted English reading comprehension in the isiZulu group. These concurrent (cross-sectional) and longitudinal relations are addressed below.

PA was a strong predictor of LRF, reading fluency and spelling concurrently at the end of grade 1 and at the start of grade 3 for both the isiXhosa and isiZulu groups after controlling for LRF and vocabulary (t1 only). Its effects on literacy were direct, and also mediated via LRF. Thus, at both t1 and t2, PA had an independent effect on both LRF and reading/spelling. This result supports that of Caravolas et al. (2012) and Makaure (2021) who also found that PA predicts reading and spelling cross-sectionally after controlling for other phonological processing skills. However, unlike what Caravolas et al. (2012) found, in this study, PA had a stronger effect on spelling than reading most likely because spelling relies on more precise phonological representations of words (Ehri, 2020). For the most part, the concurrent (cross-sectional) effects of PA on literacy were the same for the isiXhosa and isiZulu groups. Thus, this study supports the universal importance of PA for early literacy development (Landerl et al., 2022; Verhoeven & Perfetti, 2017).

There was also evidence for cross-language transfer of PA to literacy skills at t1. In grade 1, PA skills in L1 and English were related but sufficiently different from one another to such an extent that they were separate latent factors (discussed in section 7.2.2.1, above). There was evidence that PA transferred cross-linguistically for reading, but not for spelling, concurrently at t1. In grade 1, English PA had a significant direct effect on L1 reading fluency, after controlling for LRF and other phonological processing skills. However, there was no L1 PA to English reading transfer. This could be because L1 PA and L1 LRF shared more variance than English PA and LRF (the direct effect of L1 PA on LRF was larger than English PA on LRF), leaving additional variance only for English PA to explain. For example, Zugarramurdi et al. (2022) found that PA did not uniquely predict reading when controlling for letter knowledge in Spanish. Because of the consistent Spanish orthography, letter knowledge and knowledge of phonemes overlap almost entirely, leaving only letter knowledge as a significant predictor. It could be that at this early stage of reading acquisition in my study, L1 PA and L1 letter knowledge overlap, whereas English PA captured additional PA skill, such as isolating consonant clusters, which was useful for reading. This cross-language transfer was not seen for spelling: L1 PA directly predicted L1 spelling, and English PA directly predicted English spelling at t1 after controlling for LRF. This pattern of results indicates that spelling relies on language specific phonology-orthography relations, providing some support for the orthographic depth hypothesis, where different strategies are applied based on the characteristics of the orthography. At t2, PA was best conceptualised as a language general construct. It was similarly related to both L1 and English reading, and L1 and English spelling, further confirming that PA by third grade was an underlying language general meta-linguistic skill available for use in either language, thus supporting the central processing account (Geva, 2014; Geva & Siegel, 2000).

While other studies found the role of PA in literacy to be smaller at later grades as children are more proficient readers (Vaessen et al., 2010), and while one would expect PA to play less of a role in reading in consistent orthographies (Landerl et al., 2019; Ziegler et al., 2010), PA remained an important concurrent (cross-sectional) predictor in this sample of readers of consistent orthographies and its total effect was larger than the effect of RAN (Caravolas et al., 2012; Moll et al., 2014). This can be explained with reference to the overall reading proficiency of the sample which was on average low in both L1 and English with a flatter trajectory presumably because of the COVID-19 pandemic related school closures. PA is expected to play a significant role in reading and spelling when word recognition is not yet automatic, and when other skills related to reading and spelling, such as morphological awareness, are not controlled (specifically at t2 in the present study). For example, Schaefer et al. (2020) did not find an effect of PA on reading fluency in isiXhosa when morphological awareness and RAN digits were controlled in third grade. The inclusion of additional variables related to reading and spelling in the t2 cross-sectional analysis in my study could explain why the results differ from Schaefer et al. (2020).

PA was predictive of later literacy when measured at the start of grade 3, when PA was more developed, rather than when measured at the end of grade 1, when PA was less developed. T1 PA was not longitudinally related to later literacy outcomes for the isiXhosa group after controlling for LRF, other phonological processing skills and vocabulary. For the isiZulu group, t1 L1 PA was associated with English spelling at t2 and t3, and t1 English PA was associated with t2 LRF, and t3 English reading comprehension. In contrast, t2 PA predicted all t3 literacy outcomes for both groups except for English reading comprehension for the isiXhosa group (which had no significant predictors).

As mentioned earlier, the inconsistent association between t1 PA and later literacy at t2 and t3 could be because PA was not very well developed at t1. Since literacy development was also very slow in grade 1, the reciprocal relationship (and hence 'boosting' of PA skills towards the end of grade 1) that one would expect to observe was not evident in my study. Instruction did not seem to adequately support the early development of PA; since letter-sound correspondences are not always taught systematically in the South African context, progression through the various correspondences is slow (Pretorius et al., 2022). Furthermore, the COVID-19 pandemic school closures affected the total time children were instructed (Ardington, Wills, & Kotze, 2021), and school closures most likely affected access to nutrition (Shepherd & Mohohlwane, 2021). Any early gains in PA and literacy could have attenuated as a result of this. For example, an intervention in high poverty contexts in the Western Cape reported initial advantages of a grade R intervention on language and literacy skills which did not necessarily result in later advantages in grade 1 due to the slow pacing of the curriculum (Aiello et al., 2018). Thus, as suggested by Zugarramurdi et al. (2022), when PA skills are not developed (and there are, therefore, floor effects), it will be unlikely for PA to make unique contributions to later literacy. However, at t2, once PA skills had been developed via literacy instruction (Hulme & Snowling, 2013), PA was a significant predictor of later literacy in the current study.

In summary, PA skills were used in developing orthography-phonology relations and word decoding and encoding skills and it explained additional variance over and above LRF concurrently (cross-sectionally). The longitudinal relation of PA to later literacy depended on when PA was measured. When measured early in literacy acquisition, PA did not uniquely predict later literacy in this context likely because PA was not yet well developed. However, once PA skills were more developed, they did predict later literacy after controlling for letter recognition knowledge. For the most part, the relations between PA and literacy were the same for the isiXhosa and isiZulu groups. Thus, there is evidence for the universality of PA supporting later literacy (Verhoeven & Perfetti, 2022), but PA may develop more slowly in some contexts due to socioeconomic factors, (Ozernov-Palchik et al., 2017), educational factors (Pretorius et al., 2022) and/or because of the orthography used to represent the language in writing (Zugarramurdi et al., 2022).

7.2.4.3 The role of RAN

The results of this study suggest that alphanumeric RAN may relate to reading and spelling because it indexes the ability to make orthography-phonology connections. At all concurrent time points the effect of alphanumeric RAN on reading and spelling was indirect and mediated via LRF, a task which assesses familiarity with orthography-phonology relations. That is to say, RAN digits had a significant effect on LRF at t1 and t2, independently from PA, but no significant direct effect on reading and spelling at either time point. The total effect of RAN digits was significant only for t2 L1 reading fluency, t1 L1 spelling, and t2 L1 and English spelling. Non-alphanumeric RAN, which was measured using L1 RAN objects, was significantly negatively related to t1 L1 spelling only for the isiXhosa group and was negatively related to t2 L1 spelling for both groups.

The complete mediation of RAN through LRF suggests that there is large overlap in what the alphanumeric RAN and LRF tasks measure. Indeed, the LRF task is very similar to the alphanumeric RAN task in all respects including the need to make (arbitrary) orthography-phonology correspondences, except that there is a larger set size in the LRF task with low repetition of items. Meta-analyses have found that set size does not explain variation in RAN-reading correlations (Araújo et al., 2015; McWeeny et al., 2022). The important similarities between the two tasks are that speeded serial naming of alphanumeric items (which requires established orthography-phonology relations) is required for both. The speeded aspect is likely not necessarily why the LRF task mediates alphanumeric RAN. The non-alphanumeric RAN tasks had unique (and direct negative) effects on L1 spelling at t2 which were not mediated via LRF. If the alphanumeric RAN task were related to the LRF task because of similar task demands related to speed and serial naming, then the non-alphanumeric RAN tasks should also have direct effects on LRF, which they did not have. The effect of RAN also was independent of PA which had both indirect effects via LRF, and direct effects on literacy outcomes, indicating that the effect is not only phonological.

The finding that L1 RAN objects had a negative direct effect on L1 spelling (for the isiXhosa group at t1, and both groups at t2) is difficult to interpret. It may be due to RAN objects acting as a suppressor variable on the relation between RAN digits and L1 spelling. RAN objects is suppressing some of the variance in RAN digits that is not related to L1 spelling. "Suppression is defined by one variable's suppression of variance through other independent variables; allowing the independent variable to be a more 'pure' indicator of the dependent variable" (Logan et al., 2011, p. 15). Thus, English RAN digits and L1 RAN Objects share some variance with each other that is not shared with spelling, and there is an aspect of English RAN digits that is related to spelling, that is not shared with L1 RAN objects. A candidate for the shared variance between RAN digits and objects that is not shared with the spelling task is serial processing of written information. This may explain why there was no suppressive effect in the cross-sectional models with reading fluency because the spelling task did not require serial processing. Alternatively, the suppression effect may be because the RAN objects task and spelling tasks both rely on semantic knowledge (vocabulary), and/or is a pattern seen in the isiXhosa group because of their larger L1 vocabulary and smaller English vocabulary. More evidence that vocabulary may play a role in this suppression effect is from the t2 predictive model of t3 spelling. In this model, alphanumeric RAN has a negative effect on English spelling, and non-alphanumeric RAN has a positive effect on English spelling. Thus, it may be the shared semantic component between the non-alphanumeric tasks and spelling tasks that accounts for the suppressive effect. In summary, this suppression effect, seen predominantly for the isiXhosa group, is difficult to interpret and may be an anomaly in the data that deserves replication in different samples before more definitive interpretations can be made.

There are many explanations of why RAN is related to reading which include that it measures speed of lexical access (Wagner & Torgesen, 1987), speed of processing (Kail et al., 1999; Kail & Hall, 1994), orthographic processing (Wolf & Bowers, 2000), and/or it's related to reading because of shared articulation and serial processing (Papadopoulos et al., 2016) (described in chapter 2). It is likely that all accounts are supported since RAN, like reading, is multicomponential. I did not measure all the variables that would allow me to make definitive claims about how RAN is related to reading and spelling in isiXhosa and isiZulu, but I discuss some observations below.

The LRF task assesses both phonological processing (it had a significant relationship with PA) and orthographic processing. The need to use orthography-phonology correspondences could explain why the LRF task mediates the relation between RAN and reading. This extends findings by Papadopoulos et al. (2016) in their study of Greek readers from first to second grade. They also found that orthographic processing mediates the RAN-reading relation, especially when a non-alphanumeric task was used, and in a grade 4 sample, they found that orthographic processing mediates the RAN-reading relationship more strongly when the orthographic processing task is speeded (Georgiou et al., 2016). Papadopoulos et al. (2016) suggest that RAN has more of an effect via orthographic processing once reading skill has developed. Data from isiXhosa supports the shared overlap but independence of the LRF and RAN tasks. Daries (2021) found that RAN letters made a significant contribution to word specific orthographic knowledge, but not word general orthographic knowledge after controlling for LRF and PA. Overall, the results of my study suggest that RAN may contribute to reading through orthographic processing, or the ability to make orthography-phonology mappings. Thus, in one view, these results support Chen et al. (2021, p. 2575) who suggest that RAN indexes "[access to] the phonological representations of individual letters that are then used to encode orthographic patterns".

Another explanation of the mediation result is that the alphanumeric RAN task and the LRF task are both RAN tasks, with only the set-size differing between the two. For example, at t1 and t2, the correlation between RAN digits and LRF was strong, ranging from .57 - .67, and the correlation between RAN letters and LRF was also strong, r = .61 - .75. These correlations between the two tasks are, however, not large enough to justify that the tasks are measuring exactly the same construct, but rather that they are related. Since the RAN tasks have much smaller set sizes, participants may hold the items in the set active in their mental lexicon. The activation of the items would make completing the RAN tasks easier but would lead to some interference from the active items. This interference could also explain why the correlation between RAN and the LRF task is not very strong. Furthermore, the LRF task had higher correlations with literacy tasks at t1 and t2, than RAN digits or RAN letters had with the literacy tasks. In a study on isiXhosa third graders, RAN also independently contributed to oral reading fluency after controlling for orthographic processing for grade 3 isiXhosa readers (Daries, 2021). However, RAN was not a significant predictor of spelling, where letter knowledge and orthographic processing were significant. Thus, explaining the mediation in my study with reference to shared task demands does not provide a satisfactory account of the RAN-reading relationship, either.

The longitudinal relations between RAN and literacy may also be informative about why RAN is related to reading. For both groups, t1 RAN digits was positively associated with t2 LRF over and above t1 LRF, and t2 alphanumeric RAN was positively associated with t3 LRF, thereby confirming that the alphanumeric RAN and

LRF tasks are similar, but not the same, i.e., they contribute independently to later LRF. However, t1 RAN digits was not significantly related to t3 LRF. Indeed, none of the t1 predictors were significant for the isiZulu group, and only LRF was significant for the isiXhosa group. T1 RAN digits was related to t2 L1 and English reading fluency for both groups and it was significant for L1 t3 reading fluency for the isiXhosa group, and English t3 reading fluency for the isiZulu group. At t2, alphanumeric RAN predicted t3 L1 and English reading fluency, and L1 reading comprehension. Thus, the results confirm the importance of alphanumeric RAN for later reading fluency (McWeeny et al., 2022), although there may be contextual factors influencing whether it is predictive of both L1 and English reading fluency when there is a large gap between assessment points. These results then lend support to the idea that RAN is related to reading because both tasks require serial processing of symbols. While this explanation addresses the relation between RAN and reading fluency, it does not necessarily explain why RAN was related to spelling predominantly in the isiZulu group.

T1 RAN digits was longitudinally related to t2 L1 and English spelling, and t3 L1 spelling for the isiZulu group only. T2 alphanumeric RAN was related to t3 L1 spelling for the isiZulu group only. Overall, the isiZulu group had lower scores on the L1 spelling task at t2 and t3. It may be the case that a significant effect of RAN on later spelling for this group only could index different spelling strategies used. In the absence of (estimated) explicit phonics instruction, the isiZulu group may rely on spelling strategies not used by the isiXhosa group, such as using larger grain sizes for L1 spelling. The neuroscientific work of Romeo et al. (2022), for example, demonstrates that children from low SES backgrounds may develop adaptive reading strategies in the absence of supportive literacy environments. In their study, they found that reading disabled and typically reading children in the low SES category differed on their orthographic processing (as measured by RAN), rather than phonological processing. If we assume that the isiXhosa group received better L1 instruction because they were part of an intervention school, then the adaptive strategy view has some support in the current study.

Another piece of evidence to reflect on the potential underlying reason RAN is related to reading is to examine its relation to PA and PWM, and whether RAN made an independent contribution to reading/spelling after accounting for these two other skills. A latent variable model based on the central processing hypothesis for participants aged 7 to 24 finds that PA and PWM are moderately correlated to one another ($r = .67$), with weaker relations between RAN and PA ($r = .26$), and RAN and PWM ($r = .26$) in English at the latent level (Wagner et al., 2013a). The correlations in my study were much larger, especially between alphanumeric RAN and PA. At t2, the PA and alphanumeric RAN correlation was strong (isiXhosa: $r = .66$; isiZulu: $r = .69$), and weaker for the non-alphanumeric RAN and PA correlation (isiXhosa: r = .35; isiZulu: r = .56). The RAN-PWM correlations were weak for the isiXhosa group at t2 (r < .20), and moderate for the isiZulu group (r = .30 - .34). These were xxx at t1. The PA-PWM correlations were weak to moderate for the isiXhosa group (r = .27 - .40) and moderate for the isiZulu group (r = .45 - .59). That the correlations among these skills are so much higher than what has been found for English in support of the phonological processing model of Wagner and Torgesen (1987), supports the idea that RAN contributes to phonological processing ability. Nevertheless, RAN and PA made independent contributions to literacy skills concurrently (cross-sectionally) and longitudinally, suggesting the independence of these skills (Wolf & Bowers, 2000).

To summarise, RAN is likely related to reading for a variety of reasons, including contributing to phonological processing, orthographic processing, and serial processing of symbols. The correlations among PA, RAN and PWM suggest that these tasks share variance. However, since RAN's effect on reading and spelling were mediated via LRF, it suggests that RAN also indexes the ability to make and/or access orthography-phonology relations. Finally, different RAN-literacy longitudinal relations between the isiXhosa and isiZulu groups highlights the need to examine contextual factors, such as instruction and home literacy environment, which were not explicitly examined in the present study.

7.2.4.4 The role of digit span

The cross-sectional and longitudinal path models included digit span in L1 and English as indicators of PWM since the NWR task loaded poorly on the PWM factor. The scores in both languages were included because the correlations between digit span and literacy depended on the language group. In the isiXhosa group, the L1 digit span task had stronger correlations with literacy outcomes in both languages, whereas for the isiZulu group it was the English digit span task that had stronger correlations with the literacy outcomes. Thus, performance on the task depended on language exposure, the extent to which English digits were known and, arguably, the ease with which these digits could be retrieved from long-term memory in order to complete the task.

PWM is implicated in reading because it is used in holding phonological information in memory which is needed for the development of orthography-phonology correspondences, blending and segmenting words into their component sounds used in decoding and spelling, and in holding information in memory for use in reading comprehension (Gathercole & Baddeley, 1993). Furthermore, PWM is indirectly related to reading comprehension via its role in listening comprehension (which includes vocabulary) and fluent reading (Kim, 2020b; Peng et al., 2018). Based on the literature, it would be expected that PWM would be significantly related to LRF, reading fluency and spelling, as measured in this study.

The cross-sectional analyses revealed that digit span was not a significant cross-sectional predictor at t1. This may have been because of the other variables in the analyses, such as LRF, vocabulary, and PA, which are themselves influenced by digit span. In the t2 cross-sectional analysis, t2 L1 digit span was significantly related to t2 L1 reading fluency for the isiXhosa group only (LRF and PA were also significant), and t2 English digit span was significantly related to t2 LRF for the isiZulu group (PA and alphanumeric RAN were also significant). Additionally, t2 English digit span made a significant total contribution to L1 spelling at t2, for both groups. These results highlight the importance of PWM for making letter-sound correspondences, and their role in keeping phonological information in memory for blending (reading) and segmenting (spelling) (Gathercole & Baddeley, 1993). That these relations were significant cross-sectionally at t2, and not t1, indicates some developmental change in the relationship between PWM and literacy. At t1, children were almost all non-readers and were not familiar with letters; a lack of knowledge of letters precluded children from reading or spelling as they did not yet have the necessary foundations. However, at t2 (start of grade 3), almost all the participants knew at least some letters and could use these letters to decode and encode. PWM resources were then utilised at t2 to hold decoded phonological information in memory. The t2 findings are similar to Moll et al. (2014) who found a significant effect of digit span on reading fluency and spelling in Finnish, a consistently written orthography, after controlling for PA and RAN.

The longitudinal relationships between PWM and literacy depended on when PWM was measured: t1 PWM predicted later literacy outcomes, but t2 PWM did not. The longitudinal relations which included t1 predictors differed by language group even though the participants' digit span scores in L1 and English did not differ significantly at t1. T1 L1 digit span significantly predicted t2 LRF, t2 L1 reading fluency, and t2 English spelling for the isiXhosa group. T1 L1 digit span also significantly predicted t2 L1 spelling for the isiZulu group. T1 L1 digit span was a significant predictor of t3 L1 and English reading fluency, and t3 L1 reading comprehension for the isiXhosa group. For the isiZulu group, t1 L1 digit span predicted t3 spelling and reading comprehension in both languages, and t1 English digit span predicted t3 English reading fluency. These longitudinal results reflect that individual differences in PWM, as measured by digit span tasks in the first grade, are longitudinally related to later literacy outcomes, as suggested by the direct and indirect effects model of reading (Kim, 2020b). The longitudinal relationship between PWM and reading comprehension found in this study, extends the findings of Makaure (2021) who also found this longitudinal relation in a sample of Northern

Sotho-English emergent bilinguals. PWM resources are used to hold information in memory from decoding the text that enables text comprehension. A lack of an effect between t1 digit span and t3 English reading comprehension in my study for the isiXhosa group is likely due to this group's weaker command of English. While the isiXhosa group could decode the English text to the same extent as the isiZulu group at t3, the isiXhosa group lacked the English vocabulary to access meaning. Thus, PWM failed to reach significance as a t1 predictor of t3 reading comprehension because having access to the phonological representations was not useful when the semantic representations in English did not exist or were slow to be accessed due to less exposure to English. Another interesting finding is that L1, rather than English, digit span was more often significantly related to literacy outcomes, suggesting that PWM measures in L1 are better indicators of later literacy abilities in both L1 and English.

The longitudinal results using t1 predictors mirror the findings of Babayiğit and Stainthorp (2007), who also found a significant longitudinal role of digit span, but not PA, for later reading in Turkish (which is a transparently written agglutinating language, like isiXhosa and isiZulu). Similar to the present sample, Babayiğit and Stainthorp's (2007) sample had low alphabet knowledge at t1 (kindergarten), and poorly developed PA skills. They had two conclusions regarding the role of digit span in later literacy in Turkish. Firstly, they highlight that literacy development in agglutinating languages relies heavily on the PWM resources available to children since words are very long and include a number of affixes. Secondly, they also suggest that digit span may be longitudinally related to later literacy in agglutinating languages because of its role in morphosyntactic processing (Babayiğit & Stainthorp, 2007). Since I did not measure morphological awareness, I am unable to provide support for their second conclusion. With regards to their first conclusion, PWM (digit span) may have a longitudinal predictive role when it is measured at a time when letter-sound correspondence knowledge and PA skills are not yet established, as at t1 in my study and theirs. In my study, PWM (as measured by digit span) was no longer a longitudinal predictor of later literacy when it was measured at t2 (start of grade 3) when children had better developed letter-sound correspondence knowledge and PA skills. These results also support the findings of Zhang and Joshi (2020), who found that PWM is engaged at early stages of learning to read when fluency is limited. After some schooling, with the establishment of explicit knowledge of letter-sound correspondences and the ability to manipulate sounds, the load on PWM decreases. It may also be the case that a more difficult task which recruits working memory, such as a backwards digit span task, may have stronger associations with literacy once children are older and have more developed literacy skills.

7.2.4.5 *The role of vocabulary*

Vocabulary is expected to be most related to reading comprehension because of its relation to meaning, but vocabulary is also related to word reading and spelling through the direct orthographic reading route (Kim et al., 2014; Lee, 2011). Vocabulary was included in the cross-sectional model at t1. There was negative influence of English vocabulary on L1 reading fluency for both groups, and on English spelling for the isiXhosa group only. L1 vocabulary was positively related to L1 spelling at t1 for both groups. This result could indicate that children are using a whole word recognition route to spell *imoto* at this early stage of literacy development (Kim et al., 2014).

The longitudinal relations of vocabulary to later literacy stand in contrast to these cross-sectional results. Given the importance of oral language ability as a foundation on which to build literacy skills (Verhoeven & Perfetti, 2017), it was surprising that L1 vocabulary at t1 was not significantly related to later literacy outcomes at t2 or t3. However, English vocabulary at t1 was longitudinally positively related to t2 LRF, t2 L1 reading fluency, and t3 L1 and English reading fluency for the isiXhosa group. English vocabulary at t1 was negatively related to t2 English reading fluency. There were clear group differences in terms of the role of English vocabulary measured in grade 1 for later literacy, which may be related to differences in the language learning environment. As indicated previously, the isiXhosa group had less exposure to English in their home and school environment. Thus, it may be the case that the English vocabulary score at t1, does not only assess English vocabulary breadth, but also children's aptitude – that they were able to learn some English words despite being exposed to these items only a few times.

Finding no significant relation between L1 vocabulary and later literacy, especially reading comprehension, was unexpected. This result could be explained with reference to measurement factors, the simple view of reading, and vocabulary development. Firstly, the L1 vocabulary test was an adaptation of the English PPVT, using the same administration instructions from the manual. Thus, the test was stopped after eight consecutive errors in a set. The sets were designed to increase in difficulty (based on English word frequency, age of acquisition and performance data) which is likely not to have been preserved for the isiXhosa and isiZulu versions of the test. This may have led to an underestimation of L1 vocabulary in the sample (Wilsenach & Schaefer, 2022). In replications of this study, it may be better to administer the same items to all participants, thus overcoming differences in item difficulty between versions of the test. The measurement of reading comprehension skills in African contexts has also been highlighted as problematic, with many EGRA reading comprehension tests having low reliability, or reduced ranges in scores due to poor decoding skills. These aspects related to measurement could also explain the lack of an association.

With reference to the Simple View of Reading (Hoover & Gough, 1990), both decoding and oral language comprehension contribute to reading comprehension, with the relative importance of these contributions changing over development. At early stages of learning to read, decoding plays more of a role in reading comprehension, and after decoding skills are automatic, oral language comprehension plays more of a role in reading comprehension. A lack of an association between vocabulary and reading comprehension in this study may be because most of the participants are poor readers, and still relying heavily on conscious decoding. Thus, they are at a stage in reading where they cannot yet use their oral language abilities to support reading comprehension. An alternative or complementary explanation is that vocabulary, as measured at t1 in this study, is not a good enough measure of children's oral language abilities. The t1 measurement point did not take into account the influence of instruction and/or growth in vocabulary skills, and more likely reflects the participants' home background. The t1 measure is a static representation of what children knew after only six months in school. It could be the case that vocabulary measured at a later timepoint, after more school instruction, may be related to reading comprehension. Although a second vocabulary measurement point was planned for the study, the study schedule had to be adapted because of the COVID-19 pandemic impact on schooling.

7.2.5 Summary of main findings

This longitudinal study examined the longitudinal relations between bilingual phonological processing skills and bilingual reading and spelling controlling for bilingual vocabulary for isiXhosa-English and isiZulu-English emergent bilinguals. Firstly, the vocabulary results confirmed that participants were sequential emergent bilinguals on average, and had varying scores in L1 and English, highlighting that not all children begin school with the same strengths in their L1 , as assumed by the South African curriculum (Department of Basic Education, 2011a, 2011b). Below I summarise the main findings as they answer each research question posed in chapter 1.

7.2.5.1 Research Question 1: To what extent do language specific vs language general models of bilingual PA, RAN and PWM fit the data in grade 1 and grade 3 for each language group?

PA at t2, and RAN and PWM at t1 and t2 represent language general constructs, suggesting these are general underlying cognitive proficiencies which contribute to reading and spelling cross-linguistically (Cummins, 1979; Geva, 2014). Thus, there is not necessarily transfer of these skills from L1 to L2 or vice versa, but shared abilities, therefore supporting the central processing hypothesis (Geva & Siegel, 2000). The exception was PA at t1, which was best conceptualised as two language specific and highly correlated latent factors, suggesting that the initial development of PA is language specific because it is influenced by language structure, as argued in the Psycholinguistic Grain Size Theory (Ziegler & Goswami, 2005).

7.2.5.2 Research Question 2: What are the concurrent (cross-sectional) associations between bilingual phonological processing skills (PA, RAN, PWM) and bilingual literacy skills (reading fluency, spelling) for each language group in grade 1 and the start of grade 3?

PA, RAN and LRF were significant concurrent (cross-sectional) predictors of literacy skills at t1 and t2, confirming the universality of these skills for literacy development across orthographies and languages for monolingual and multilingual readers (Landerl et al., 2022; Verhoeven & Perfetti, 2017). The first realisation needed for learning how to read is that language includes smaller sounds (phonemes), and that letters represent these sounds. Thus, it was not surprising that LRF, which measures the automaticity of orthography-phonology correspondences, was significantly related to L1 and English reading and spelling. These correspondences were language general and language specific: while the LRF task was related to both L1 and English literacy, the coefficients were smaller for the English tasks than the L1 tasks.

The effect of RAN was direct only on LRF (addressed in more detail in section 7.2.4.3) with its total effect via LRF on literacy being significant at t2. The effect of PA was indirect via LRF, as well as direct on literacy skills at both time points. Cross-linguistic transfer of PA was evident at t1, where PA was language specific. English PA, and not L1 PA, directly contributed to both L1 and English reading fluency at t1. However, t1 spelling skills were influenced by language specific PA skills. These results highlight that children use both language specific and language general PA skills for bilingual reading and spelling, and that PA is used in forming letter-sound correspondences too.

Digit span was a significant predictor only at t2 for L1 reading fluency in the isiXhosa group, for LRF in the isiZulu group, and for L1 spelling for both groups. Thus, the role of PWM was limited to only some literacy tasks, and only later on in literacy development. PWM is used in establishing orthography-phonology correspondences, blending and segmenting which are required for LRF, reading and spelling, respectively (Gathercole & Baddeley, 1993). Digit span may have not been a predictor of literacy skills at t1 since most children were not familiar with letters yet. However, at t2, once children were familiar with some letters, PWM additionally contributed to variance in reading and spelling concurrently (cross-sectionally).

Overall, then, these results confirm the importance of code-related skills, such as LRF and PA, as well as RAN and PWM as predictors of literacy in consistent orthographies. Additionally, PA and LRF remained strong concurrent (cross-sectional) predictors of literacy. These results demonstrate that the educational context must be considered in understanding the role of phonological processing skills in literacy development. While research in developed contexts demonstrates that PA reduces in importance in later grades (Vaessen & Blomert, 2010), in this sample PA continued to be an important predictor at the beginning of the third grade, possibly because the school and home environment do not sufficiently support the fast acquisition of decoding skills in L1. Thus, because literacy develops so much more slowly, as seen also in the longitudinal development of literacy skills, PA remains an important concurrent (cross-sectional) predictor of literacy. In support of the psycholinguistic grain size theory, PA in each language was recruited for reading and spelling at t1, with cross-language transfer present for reading fluency, but not spelling.

7.2.5.3 Research Question 3: What are the longitudinal associations between bilingual phonological processing skills (PA, RAN, PWM) measured in grade 1 and bilingual literacy skills (reading fluency, spelling, reading comprehension) measured in grade 3 for each language group?

The importance of PA, RAN and PWM as longitudinal predictors of literacy depended on the time at which the skills were measured, reflecting differences in skill level at each timepoint.

At t1, letter-sound correspondence knowledge and PA skills were not well established. With few exceptions, PA measured at the end of grade 1 (t1) was not a stable longitudinal predictor of literacy skills, even though the longitudinal correlation with literacy was moderate to strong. PWM (as measured by digit span at t1) was often a longitudinal predictor of later literacy. English RAN digits at t1 was also longitudinally related to later reading fluency and reading comprehension. Overall, the models explained a large proportion in the variance of the outcomes. At t2, when PA skills and letter-sound recognition were more developed, PA was a consistent predictor of later (t3) L1 and English reading fluency, L1 and English spelling and L1 reading comprehension for both the isiXhosa and isiZulu groups. PA was also a predictor of English reading comprehension for the isiZulu group. Alphanumeric RAN at t2 supported L1 reading fluency in both groups. PWM no longer was a longitudinal predictor.

Overall, my study demonstrates that different phonological processing skills influence literacy development at different points in time. If PA and letter knowledge are not well-established during the first year of reading development, due to the educational and social context, PWM is a more stable predictor of later literacy attainment. However, once letter knowledge is developed and PA skills are stronger, my data replicated what has been found for other contexts: PA is a stable predictor of later literacy, and PWM ceases to be a predictor. Some caution is warranted in generalising these findings to other contexts: the COVID-19 pandemic affected participants between t1 and t2 because of school closures, and between t2 and t3 because of rotational timetabling. It is not possible to determine to what extent these school closures may have influenced the longitudinal relations.

7.2.5.4 Research Question 4: To what extent do scores on phonological processing and literacy tasks develop over time for each language group?

Scores on the phonological processing and literacy tasks improved over time, except for English blending, L1 RAN objects and L1 digit span tasks. A lack of growth in English blending may be due to measurement factors such as the accent used in the recordings, and the L1 RAN objects and L1 digit span tasks may have been affected by language exposure, where English was more often used to name the items used in the tasks.

The longitudinal development of these task scores was the same for both language groups, with the exception of most of the PWM tasks, and L1 reading tasks. For the isiXhosa group, their growth in L1 NWR was negative, and flatter than the growth for the isiZulu group for English digit span and NWR. These findings were explained by referring to measurement issues based on noise in the school environment, and changes in the research assistants. The growth of reading was slow between t1 and t2, but sped up to t3, which followed the same pattern of growth as children who struggle to acquire foundational letter-sound correspondence knowledge (Wills, Ardington, & Sebaeng, 2022). The isiXhosa group had faster growth in L1 reading fluency skills, leading to a medium effect size advantage on LRF, word and text reading fluency, and spelling at t3 compared to the isiZulu group. I suggest that these differences are due to explicit L1 literacy instruction via the Funda Wande intervention in the isiXhosa school. Teaching practices were not observed so the evidence here is speculative.

7.2.5.5 Research Question 5: What are the concurrent and longitudinal associations between vocabulary and literacy skills after controlling for phonological processing skills?

The participants in this study were sequential emergent bilinguals with larger L1 than English vocabularies. The isiXhosa group had a higher score on L1 vocabulary than the isiZulu group, and for English the isiZulu group had a higher vocabulary score than the isiXhosa group. At t1, cross-sectionally, English vocabulary was negatively associated with L1 reading fluency, and L1 vocabulary was positively related to L1 spelling. The longitudinal vocabulary relations depended on group membership. English vocabulary was positively related to English reading fluency for the isiXhosa group, but negatively related for the isiZulu group. These differences may reflect language learning environments. L1 vocabulary was not related to literacy outcomes. With regards to the Simple View of Reading (Hoover & Gough, 1990), a lack of association of vocabulary may be due to the early stages of reading development in this sample, such that decoding, rather than oral language skills, plays a larger role in reading comprehension.

7.2.5.6 Research Question 6: What do the concurrent and longitudinal associations reveal about why RAN may be related to literacy?

In the cross-sectional analyses, alphanumeric RAN had a direct effect on LRF, and an indirect effect on reading and spelling which was mediated by LRF. PA and RAN both contributed significantly to LRF, and PA had a direct effect on reading and spelling. I, therefore, suggest that alphanumeric RAN measures orthographic processing, or the ability to make orthography-phonology correspondences. While RAN and PA had moderate to strong correlations, they had different effects on literacy outcomes.

7.3 IMPLICATIONS OF THE RESEARCH

7.3.1 Implications for theories of L1 and L2 reading development and cross-language transfer

This study provides additional evidence for the universality of PA, RAN and graphic symbol knowledge as predictors of literacy cross-linguistically. The research indirectly supports the tenets of the Psycholinguistic Grain Size Theory (Ziegler & Goswami, 2005) which argues that literacy development is constrained by the availability of phonological units in the language, the way these units are represented in orthography (granularity), and the consistency of these correspondences. A grain is the mapping between orthography and phonology, e.g., a small grain size is the letter-phoneme correspondence. Reading develops more slowly when more grains, and grains of different sizes, need to be learned. For isiXhosa and isiZulu, the phonological units most available are the syllable (e.g., Diemer, 2016; Diemer et al., 2015). isiXhosa and isiZulu are written in an alphabetic orthography which uses the letter as the smallest orthographic grain. The letter-sound correspondences are consistent so a small grain size should be used, and literacy should develop quickly. However, there are still many correspondences/grains to be learned given the large consonant inventory, a point not acknowledged in the PGST. In the absence of systematic explicit instruction in orthography-phonology correspondences, as is the case in South Africa, reading will develop slowly, which is what was found in this study. Indeed, the slow pace of phonics instruction in African languages is acknowledged as a hurdle in South African education currently (Pretorius et al., 2022). Thus, while the PGST suggests that literacy will develop more slowly when grains of *various* sizes need to be learned (as in English, for example, due to the inconsistency at the letter-phoneme level), the theory should also acknowledge the *number* of grains at any *specific* grain size. In their critique of the PGST, Daniels and Share (2018) refer to this as inventory size. While other languages may have unique graphic symbols for each phoneme, letter groups are used to represent additional phonemes not already represented by the 26 letters of the Latin alphabet. The PGST can also be considered from the perspective of becoming biliterate, where the number of grains may be even higher (to represent language specific phonemes), and orthography-phonology correspondences learned in one language may conflict with those learned in the other, e.g., [i:] represented as *i* in isiXhosa/isiZulu but *ee* or *ea* in English. Thus, the development of reading in biliterate readers should be expected take longer because of this complexity.

Overall, the research supported the interdependence hypothesis and central processing hypothesis. Phonological processing skills were language general and available for both L1 and L2 literacy development. The correlations between L1 and L2 reading and L1 and L2 spelling were strong, suggesting some level of transfer. Weaker correlations between these skills in the isiXhosa group reflect instructional practices which are less focussed on English, thereby supporting the role of instruction in interdependence.

7.3.2 Implications for educational policy makers and teachers

The findings were similar for the isiXhosa and isiZulu groups indicating that literacy develops similarly for readers of closely related languages. Furthermore, these findings were very similar to what has been found for reading development in other consistent orthographies, even for languages with different phonological structures, and for contexts with different instructional approaches. Thus, policy makers can use both international and national research that explores the same constructs.

My research implies that recent efforts by the Department of Basic Education to supply reading benchmarks for Nguni languages (Ardington, Wills, Pretorius, et al., 2021) which pools together data from isiXhosa, isiZulu and Siswati is an appropriate methodological choice. Furthermore, providing LRF benchmarks provides an initial screening tool. LRF tasks are easy to administer compared to PA tasks and will also provide some information about PA skills since PA predicts LRF. Teachers should feel comfortable to apply these LRF and text-reading fluency benchmarks for monitoring student progress in their classrooms. These scores can also be used in screening to identify children at risk for reading failure. Children who struggle to acquire basic letter-sound knowledge should be identified early and provided with additional systematic instruction. Given the importance of letter-sound knowledge for literacy in L1 and English, teachers should prioritise teaching these correspondences early on in instruction and providing children with books to practice using these skills (Pretorius et al., 2022). This will allow children to develop sufficient skills to benefit from independent reading.

The cross-language correlation between L1 and English differed depending on estimated instruction in English, specifically, the correlations were weaker for the isiXhosa group. In the absence of language specific instruction, the strong correlation between L1 and L2 reading, and spelling may not be found. Because English is inconsistent and requires the development of various language specific grain sizes, teachers will need to explicitly teach English phonics, and provide children with opportunities to practice. The similarities between orthographies should be emphasised, reducing the number of total correspondences that need to be instructed in each language.

Finally, vocabulary was identified as an area that requires attention, as some children had small and underdeveloped L1 vocabularies, compared to their peers. Teachers and policy makers should not assume that all children come to school with strengths in their L1 vocabulary knowledge. Teachers, thus, need to consider how to support both the L1 and English language development of children in school, for example, through storybook reading of authentic texts (Stoffelsma, 2019a), and direct instruction. Especially for English vocabulary development, teachers will need to consider how to progress students from basic high frequency vocabulary to more academic and low frequency vocabulary to prepare them for the switch to English instruction in grade 4.

7.3.3 Implications for researchers

This study also has implications for researchers, particularly with regard to measurement. South African researchers have noticed the need for language and context appropriate assessments for bilinguals (van Dulm & Southwood, 2014). The parallel phonological processing research instruments developed for this study (described in chapter 3) are a possible solution for phonological processing tests in South Africa and are openly accessible on OSF at https://osf.io/gmnws/. The results, especially for PA, were reliable, and had construct validity with the CTOPP. The data from the RAN tasks highlighted the need to consider language experience before uncritically deciding to use a task (e.g., RAN objects) which requires language experience. I would suggest that the NWR task developed as part of this instrument be revised before use in another research study. While there was sufficient internal reliability, the scoring of the task was problematic in the school contexts in which the task was used. The PPVT was adapted for the current study into isiXhosa and isiZulu, and the administration procedures from the manual were followed. Upon reflection of unexpectedly finding no L1 vocabulary longitudinal relations to later literacy, I would suggest future researchers administer a certain number of items to all participants as the adaptation of the test into a new language does not preserve the original item difficulty levels, possibly underestimating L1 vocabulary size (Wilsenach & Schaefer, 2022).

7.4 LIMITATIONS AND RECOMMENDATIONS FOR FUTURE RESEARCH

The scope of this study included examining literacy as defined as the ability to read and write and what predicts it longitudinally. Phonological processing and vocabulary skills were measured. A close-ended questionnaire was completed by half the parents in the study to gather information about the language and literacy exposure of the child participants. Thus, this study was limited to understanding the cognitive mechanisms related to reading and spelling within the individual, and the social and affective factors which may have influenced literacy development were not explored. As literacy can also be conceptualised as a socially-constructed practice which takes place in specific environments (Gee, 1999; Yaden et al., 2021), future research could examine the socio-cultural, socio-educational and instructional context in which literacy develops. This would include more qualitative approaches such as observations, interviews and/or case studies at the school and home with child, teacher, and parent participation. For example, Pretorius and Machet (2004) observed teaching practices and interviewed teachers using a close ended questionnaire. These methods helped them uncover that literacy was being learned and practiced in print poor environments, where teachers themselves did not necessarily have a love of reading. Using mixed methods, Ardington et al. (2019) were able to estimate the effect of reading clubs focused on reading for enjoyment on children's reading practices and scores, and Khosa (2021) was able to describe the classroom practices of grade 1 teachers, and the practices of their curriculum advisors. Qualitative and mixed methods approaches used to understand the home and classroom environment can, therefore, uncover the situational and cultural factors that affect and contribute to literacy outcomes.

The COVID-19 pandemic related school closures and effects on home life and nutrition may limit the external validity of this research. South African research indicates that the school closures and rotational timetabling led to learning losses of up to one year (Ardington, Wills, & Kotze, 2021), and increased child hunger (Shepherd & Mohohlwane, 2022). Given these learning losses, it is expected that the scores presented in this study are lower than what would have been found had there not been school closures. The rate of growth in the reading and spelling skills may have been affected by these school closures but I believe that that the correlations between skills were unaffected. For example, the correlations among literacy skills are within the same range as studies conducted before the pandemic (e.g., Schaefer &

Kotzé, 2019). It may be prudent to generalise these findings to only first and second grade readers, keeping in mind the influence of the pandemic on total scores. Three schools participated in this study, but schools vary considerably in their instruction. While at least 70 participants were recruited to capture a large range in variation, future studies could include more schools, and use appropriate statistical models, such as hierarchical linear models or clustered standard errors, to account for the variance at the cluster (school) level. My study could be replicated to determine whether the results hold for third grade samples at different schools during 'normal' schooling.

The longitudinal research design allowed some loosely causal interpretations[35] (Castles & Coltheart, 2004) of how phonological processing skills were related to reading and spelling, however, these conclusions are limited to the developmental time measured in this study, from grade 1 to grade 3. For better clarity around causal relationships, future studies could assess skills before the start of formal literacy instruction, i.e., before grade 1 (Hulme & Snowling, 2013). Additionally, participants could be followed for longer periods of time to determine the long run importance of foundational literacy skills.

A strength of this study was the use of multiple measures for the same construct so that measurement error could be accounted for using statistical approaches. I urge future researchers to include multiple measures to support such techniques so that inferences will be more reliable. Because multiple measures in multiple languages were administered, interesting patterns in RAN development for emergent bilinguals was identified in my study, and by Makaure (2021). Georgiou et al. (2022) provide evidence on bilingual RAN for adult readers in eight different languages, but there is less research on bilingual RAN for novice readers, and a lack of research from Africa where educational contexts are different. More exploration of bilingual RAN could shed light on why RAN is related to reading. Finally, the scope of the study was limited to phonological processing, and did not measure the role of other important metalinguistic skills such as orthographic awareness (Daries, 2021), morphological awareness (Rees, n.d.; Schaefer et al., 2020) and syntactic awareness. Recent research that examined these skills identify them to be important unique contributors to reading and spelling. Vocabulary is another under-researched variable in African research (Wilsenach & Schaefer, 2022) and could only be measured once in my study. These constructs should be further examined in both cross-sectional and

[35] The interpretation of the results of this study are loosely causal since not all confounding variables could be measured. Experimental and quasi-experimental studies could better provide causal information about the longitudinal relations of these variables with literacy.

longitudinal studies to develop a more nuanced understanding of literacy development in isiXhosa and isiZulu.

Another limitation, which applies not only to this study, but to early grade reading research in developing countries in general, is the high prevalence of floor effects in reading, spelling and phonological awareness tasks (e.g., Kim & Piper, 2019). While every effort was made to create tasks that were sensitive to different developmental periods, the reality is that children perform poorly on even the easiest tasks (such as letter-sound recognition and syllable blending tasks) because of the socio-educational context. Floor effects reduce the associations between variables. Thus, PA measured in Grade 1 may not have been significantly related to reading outcomes longitudinally due to floor effects in both PA and reading measures. Future studies could attempt to develop even more sensitive PA tasks for children in these contexts to better understand the PA-reading relationship. It is also possible that different data analytic decisions could have led to different results, what is termed "researcher degrees of freedom" (Wicherts et al., 2016). I chose to include both L1 and L2 variables in the same path analysis, whereas it would also have been justifiable to test the predictors separately for L1 and L2, before including both L1 and L2 variables in the same path model. Secondly, I used principal components analysis (PCA), rather than factor analysis to reduce the number of variables in the path analyses as principal components analysis has been used by other South African early grade reading researchers (e.g., Taylor et al., 2017). While both approaches are feasible approaches to data reduction, factor analysis has the added advantage of estimating measurement error. Thus, the use of PCA may result in slightly different findings due to the inclusion of measurement error in the estimated variables. Furthermore, the linear mixed effects models included only linear terms for time, where non-linear trajectories (such as squared terms) could have been included since there were three timepoints. Future researchers could consider how their analytic choices may affect the study outcomes by running the alternative analyses as part of sensitivity analysis.

Other avenues of research which this study informs is training studies and the development of screeners to identify children at risk. Causal evidence can also be obtained from training studies (Hulme & Snowling, 2013). For example, if an intervention aimed at PA improves both PA and reading, then that is evidence that PA is related to reading. A training study could be conducted that examines the effectiveness of explicit syllable-orthography grain size instruction compared to explicit phoneme-letter grain size instruction, compared to business as usual instruction as the debate around phoneme vs syllable instruction in African languages continues (Department of Basic Education, 2020b; Trudell & Schroeder, 2007). The study by Sargiani et al. (2021) in Portuguese would be worth replicating to address this instructional debate. Studies of RAN instruction and its effect on RAN and reading/spelling are inconclusive and is an avenue of further research (McWeeny et al., 2022). The study of Vander Stappen and Van Reybroeck (2018) could be replicated and extended to include alphanumeric RAN instruction, and a control group. Replications of the above-mentioned studies should be informed by power analyses to enhance the probability of finding a true effect, and the use of equivalency tests can rule out whether an effect is different from zero (Lakens, 2022).

Screeners (a battery of tests used to identify children at risk for reading failure) are not used widely in South Africa, although the recent surge in interest in the EGRA and LRF and reading fluency benchmarks could be considered a form of screening. In agreement with McWeeny et al. (2022), my study reveals that RAN should be included in the battery of tests used as screeners as RAN influences LRF, a precursor to reading and spelling. Relatedly, RAN scores should be interpreted in line with relevant norms (that would need to be developed in the South African context), and with the consideration that non-alphanumeric tasks may be affected by language exposure. PA should also be assessed as part of a screening battery, for example as included in the screener of Clark et al. (2019) for isiXhosa. Given the developmental nature of bilingual PA, PA should be assessed in L1 at the start of literacy instruction as far as possible. However, since PA develops slowly in the current sample of children, a letter-knowledge task may also help identify children in need of additional support in the classroom. Since PWM also contributed to literacy concurrently (cross-sectionally) and longitudinally, measures of PWM should also be included in screeners too. Digit span tasks worked best in the present study of emergent bilinguals.

7.5 CONCLUSION

This study confirmed the importance of letter knowledge, PA, RAN, PWM and vocabulary in literacy development thereby adding to the body of research which explores the cognitive precursors of literacy development cross-linguistically and longitudinally. Different skills were important for literacy at different points in time. At early stages of learning to read, when PA was not yet developed, PWM longitudinally predicted most literacy skills. However, after PA and letter knowledge had developed, PA became a stable predictor of later literacy. These relations held for first and second language reading development, and for two groups of children reading closely related languages. Letter knowledge, PA and RAN were common underlying proficiencies used for reading and spelling in L1 and L2, and there were strong correlations between L1 and L2 literacy, implying language transfer, especially when the L2 was instructed.

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9 APPENDIX

9.1 A1: PERMISSION TO CONDUCT RESEARCH (ETHICAL CLEARANCE)

9.1.1 A1.1: Permission from the University of South Africa

UNISA university of south africa

COLLEGE OF HUMAN SCIENCES RESEARCH ETHICS REVIEW COMMITTEE

01 March 2019

Dear Maxine Nichole Schaefer

NHREC Registration #:Rec-240516-052
CREC Reference: 2019-CHS-0245
Name: Maxine Nichole Schaefer
Student #: 64107345

Decision: Ethics Approval from 01 March 2019 to 28 February 2024.

Researcher(s): Maxine Nichole Schaefer
schaemn@unisa.ac.za

Supervisor (s): AC Wilsenach
Department of Linguistics and Modern Languages
0124296045

Research Title

Phonological processing skills and their longitudinal relation to Home and Additional language literacy in IsiXhosa and IsiZulu speaking

Qualification: PhD (Linguistics and Modern Languages)

College of Human Science ethics chairperson hereby acknowledge your application for Research Ethics Certificate; approval is granted for five years

The meduim risk application was reviewed by a sub committee of URERC on 27 February 2019 in compliance with the Unisa Policy on Research Ethics and the Standard Operating Procedure on Research Ethics Risk Assessment. The decision was approved on 01 March 2019.

The proposed research may now commence with the provisions that:

1. The researcher(s) will ensure that the research project adheres to the values and principles expressed in the UNISA Policy on Research Ethics.

Open Rubric

University of South Africa
Preller Street, Muckleneuk Ridge, City of Tshwane
PO Box 392 UNISA 0003 South Africa
Telephone: +27 12 429 3111 Facsimile: +27 12 429 4150
www.unisa.ac.za

2. Any adverse circumstance arising in the undertaking of the research project that is relevant to the ethicality of the study should be communicated in writing to the CHS Research Ethics Committee.
3. The researcher(s) will conduct the study according to the methods and procedures set out in the approved application.
4. Any changes that can affect the study-related risks for the research participants, particularly in terms of assurances made with regards to the protection of participants' privacy and the confidentiality of the data, should be reported to the Committee in writing, accompanied by a progress report.
5. The researcher will ensure that the research project adheres to any applicable national legislation, professional codes of conduct, institutional guidelines and scientific standards relevant to the specific field of study. Adherence to the following South African legislation is important, if applicable: Protection of Personal Information Act, no 4 of 2013; Children's act no 38 of 2005 and the National Health Act, no 61 of 2003.
6. Only de-identified research data may be used for secondary research purposes in future on condition that the research objectives are similar to those of the original research. Secondary use of identifiable human research data require additional ethics clearance.
7. No field work activities may continue after the expiry date (28 February 2024). Submission of a completed research ethics progress report will constitute an application for renewal of Ethics Research Committee approval.

Note: The reference number 2018-CHS-0245 *should be clearly indicated on all forms of communication with the intended research participants, as well as with the Committee.*

Yours sincerely,

Signature

CREC Chairperson
Dr. Suryakanthie Chetty
Chetts@unisa.ac.za
0124296267

Executive Dean: CHS
Prof. AP Phillips
Phillap@unisa.ac.za
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9.1.2 A1.2: Permission from the Eastern Cape Department of Education

Province of the
EASTERN CAPE
EDUCATION

STRATEGIC PLANNING POLICY RESEARCH AND SECRETARIAT SERVICES
Steve Vukile Tshwete Complex • Zone 6 • Zwelitsha • Eastern Cape
Private Bag X0032 • Bhisho • 5605 • REPUBLIC OF SOUTH AFRICA
Tel: +27 (0)40 608 4773/4035/4537 • Fax: +27 (0)40 608 4574 • Website: www.ecdoe.gov.za

Enquiries: B Pamla Email: babalwa.pamla@ecdoe.gov.za Date: 10 April 2019

Ms. Maxine Nichole Shaefer

[redacted]

Pretoria

8261

Dear Ms Shaefer

PERMISSION TO UNDERTAKE A DOCTORAL RESEARCH: PHONOLOGICAL PROCESSING SKILLS AND THEIR LONGITUDINAL RELATION TO HOME AND ADDITIONAL LANGUAGE LITERACY IN ISIXHOSA AND ISIZULU SPEAKING CHILDREN

1. Thank you for your application to conduct research.
2. Your application to conduct the above mentioned research from 2 selected primary schools in the Buffalo City District, under the jurisdiction of the Eastern Cape Department of Education (ECDoE) is hereby approved based on the following conditions:
   a. there will be no financial implications for the Department;
   b. institutions and respondents must not be identifiable in any way from the results of the investigation;
   c. you seek parents' consent for minors;
   d. it is not going to interrupt educators' time and task;
   e. you present a copy of the written approval letter of the Eastern Cape Department of Education (ECDoE) to the Cluster and District Directors before any research is undertaken at any institutions within that particular district;
   f. you will make all the arrangements concerning your research;
   g. the research may not be conducted during official contact time, provided that an arrangement to do research at the school including getting inside a classroom has been arranged and agreed upon in writing with the Principal and the affected teacher;

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Ikamva eliqaqambileyo!

h. should you wish to extend the period of research after approval has been granted, an application to do this must be directed to Chief Director: Strategic Management Monitoring and Evaluation;

i. your research will be limited to those institutions for which approval has been granted, should changes be effected written permission must be obtained from the Chief Director: Strategic Management Monitoring and Evaluation;

j. you present the Department with a copy of your final paper/report/dissertation/thesis free of charge in hard copy and electronic format. This must be accompanied by a separate synopsis (maximum 2 – 3 typed pages) of the most important findings and recommendations if it does not already contain a synopsis.

k. you present the findings to the Research Committee and/or Senior Management of the Department when and/or where necessary.

l. you are requested to provide the above to the Chief Director: Strategic Management Monitoring and Evaluation upon completion of your research.

m. you comply with all the requirements as completed in the Terms and Conditions to conduct Research in the ECDoE document duly completed by you.

n. you comply with your ethical undertaking (commitment form).

o. You submit on a six monthly basis, from the date of permission of the research, concise reports to the Chief Director: Strategic Management Monitoring and Evaluation

3. The Department reserves a right to withdraw the permission should there not be compliance to the approval letter and contract signed in the Terms and Conditions to conduct Research in the ECDoE.

4. The Department will publish the completed Research on its website.

5. The Department wishes you well in your undertaking. You can contact the Director, Ms. NY Kanjana on the numbers indicated in the letterhead or email nelisa.kanjana@ecdoe.gov.za should you need any assistance.

NY KANJANA
DIRECTOR: STRATEGIC PLANNING POLICY AND RESEARCH

FOR SUPERINTENDENT-GENERAL: EDUCATION

q

Province of the
EASTERN CAPE
EDUCATION

CORPORATE PLANNING MONITORING POLICY AND RESEARCH COORDINATION
Steve Vukile Tshwete Complex • Zone 6 • Zwelitsha • Eastern Cape
Private Bag X0032 • Bhisho • 5605 • REPUBLIC OF SOUTH AFRICA
Tel: +27 (0)40 608 4537/4773 • Fax: +27 (0)86 742 4942 • Website: www.ecdoe.gov.za

Enquiries: B Pamla Email: babalwa.pamla@ecdoe.gov.za Date: 15 December 2020

Ms Maxine Nichole Schaefer

[redacted]

Pretoria

8262

Dear MN Schaefer

PERMISSION TO UNDERTAKE A DOCTORAL RESEARCH: PHONOLOGICAL PROCESSING SKILLS AND THEIR LONGITUDINAL RELATION TO HOME AND ADDITIONAL LANGUAGE LITERACY IN ISIXHOSA AND ISIZULU SPEAKING CHILDREN

1. Your application to conduct the above-mentioned research in two selected Primary Schools from the Buffalo City District of the Eastern Cape Department of Education (ECDoE) is hereby approved based on the following conditions:

    a. there will be no financial implications for the Department;

    b. institutions and respondents must not be identifiable in any way from the results of the investigation;

    c. no minors will participate;

    d. it is not going to interrupt educators' time and task;

    e. the research may not be conducted during official contact time;

    f. no physical contact with educators and learners, only virtual means of communication should be used and that should be arranged and agreed upon in writing with the Principal and the affected teacher/s;

    g. you present a copy of the written approval letter of the Eastern Cape Department of Education (ECDoE) to the Cluster and District Directors before any research is undertaken at any institutions within that particular district;

h. you will make all the arrangements concerning your research;

i. should you wish to extend the period of research after approval has been granted, an application to do this must be directed to Chief Director: Corporate Strategy Management;

j. you present the Department with a copy of your final paper/report/dissertation/thesis free of charge in hard copy and electronic format. This must be accompanied by a separate synopsis (maximum 2 – 3 typed pages) of the most important findings and recommendations if it does not already contain a synopsis;

k. you present the findings to the Research Committee and/or Senior Management of the Department when and/or where necessary;

l. you are requested to provide the above to the Chief Director: Corporate Strategy Management upon completion of your research;

m. you comply with all the requirements as completed in the Terms and Conditions to conduct Research in the ECDoE document duly completed by you;

n. you comply with your ethical undertaking (commitment form);

o. You submit on a six-monthly basis, from the date of permission of the research, concise reports to the Chief Director: Corporate Strategy Management.

2. The Department reserves a right to withdraw the permission should there be non-compliance to the approval letter and contract signed in the Terms and Conditions to conduct Research in the ECDoE and/or legal requirements to do so.

3. The Department will publish the completed Research on its website.

4. The Department wishes you well in your undertaking. You can contact the Mrs. B Pamla on the numbers indicated in the letterhead or email babalwa.pamla@ecdoe.gov.za should you need any assistance.

T MASOEU

CHIEF DIRECTOR: CORPORATE STRATEGY MANAGEMENT

FOR SUPERINTENDENT-GENERAL: EDUCATION

9.1.3 A1.3: Permission from the Gauteng Department of Education

GAUTENG PROVINCE
Department: Education
REPUBLIC OF SOUTH AFRICA

8/4/4/1/2

GDE RESEARCH APPROVAL LETTER

Date:	**31 January 2019**
Validity of Research Approval:	**05 February 2019 – 30 September 2019** **2018/380**
Name of Researcher:	**Schaefer MN**
Address of Researcher:	[redacted]
	Johannesburg, 2191
Telephone Number:	**012 429 8278/ 083 259 8261**
Email address:	**schaemn@unisa.ac.za**
Research Topic:	**Phonological processing skills and their longitudinal relation to home and Additional language literacy in isiXhosa and isiZulu speaking children**
Type of qualification	**PhD**
Number and type of schools:	**Two Primary Schools**
District/s/HO	**Tshwane South**

Re: Approval in Respect of Request to Conduct Research

This letter serves to indicate that approval is hereby granted to the above-mentioned researcher to proceed with research in respect of the study indicated above. The onus rests with the researcher to negotiate appropriate and relevant time schedules with the school/s and/or offices involved to conduct the research. A separate copy of this letter must be presented to both the School (both Principal and SGB) and the District/Head Office Senior Manager confirming that permission has been granted for the research to be conducted.

The following conditions apply to GDE research. The researcher may proceed with the above study subject to the conditions listed below being met. Approval may be withdrawn should any of the conditions listed below be flouted:

1

Making education a societal priority

04/02/2019

Office of the Director: Education Research and Knowledge Management
7th Floor, 17 Simmonds Street, Johannesburg, 2001
Tel: (011) 355 0488
Email: Faith.Tshabalala@gauteng.gov.za
Website: www.education.gpg.gov.za

1. *The District/Head Office Senior Manager/s concerned must be presented with a copy of this letter that would indicate that the said researcher/s has/have been granted permission from the Gauteng Department of Education to conduct the research study.*
2. *The District/Head Office Senior Manager/s must be approached separately, and in writing, for permission to involve District/Head Office Officials in the project.*
3. *A copy of this letter must be forwarded to the school principal and the chairperson of the School Governing Body (SGB) that would indicate that the researcher/s have been granted permission from the Gauteng Department of Education to conduct the research study.*
4. *A letter / document that outline the purpose of the research and the anticipated outcomes of such research must be made available to the principals, SGBs and District/Head Office Senior Managers of the schools and districts/offices concerned, respectively.*
5. *The Researcher will make every effort obtain the goodwill and co-operation of all the GDE officials, principals, and chairpersons of the SGBs, teachers and learners involved. Persons who offer their co-operation will not receive additional remuneration from the Department while those that opt not to participate will not be penalised in any way.*
6. *Research may only be conducted after school hours so that the normal school programme is not interrupted. The Principal (if at a school) and/or Director (if at a district/head office) must be consulted about an appropriate time when the researcher/s may carry out their research at the sites that they manage.*
7. *Research may only commence from the second week of February and must be concluded before the beginning of the last quarter of the academic year. If incomplete, an amended Research Approval letter may be requested to conduct research in the following year.*
8. *Items 6 and 7 will not apply to any research effort being undertaken on behalf of the GDE. Such research will have been commissioned and be paid for by the Gauteng Department of Education.*
9. *It is the researcher's responsibility to obtain written parental consent of all learners that are expected to participate in the study.*
10. *The researcher is responsible for supplying and utilising his/her own research resources, such as stationery, photocopies, transport, faxes and telephones and should not depend on the goodwill of the institutions and/or the offices visited for supplying such resources.*
11. *The names of the GDE officials, schools, principals, parents, teachers and learners that participate in the study may not appear in the research report without the written consent of each of these individuals and/or organisations.*
12. *On completion of the study the researcher/s must supply the Director: Knowledge Management & Research with one Hard Cover bound and an electronic copy of the research.*
13. *The researcher may be expected to provide short presentations on the purpose, findings and recommendations of his/her research to both GDE officials and the schools concerned.*
14. *Should the researcher have been involved with research at a school and/or a district/head office level, the Director concerned must also be supplied with a brief summary of the purpose, findings and recommendations of the research study.*

The Gauteng Department of Education wishes you well in this important undertaking and looks forward to examining the findings of your research study.

Kind regards

……………………………………………………

Mr Gumani Enos Mukatuni
Acting CES: Education Research and Knowledge Management

DATE: 04/02/2019……………………

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GAUTENG PROVINCE

Department: Education

REPUBLIC OF SOUTH AFRICA

8/4/4/1/2

GDE RESEARCH APPROVAL LETTER

Date:	**25 January 2021**
Validity of Research Approval:	**08 February 2021– 30 September 2021** **2018/380AA**
Name of Researcher:	**Schaefer MN**
Address of Researcher:	[redacted]
	Johannesburg
Telephone Number:	**012 429 8278/ 083 259 8261**
Email address:	Schaemn@unisa.ac.za
Research Topic:	**Phonological processing skills and their longitudinal relation to home and Additional language literacy in IsiXhosa speaking children**
Type of qualification	**PhD**
Number and type of schools:	**2 Primary Schools**
District/s/HO	**Tshwane South**

Re: Approval in Respect of Request to Conduct Research

This letter serves to indicate that approval is hereby granted to the above-mentioned researcher to proceed with research in respect of the study indicated above. The onus rests with the researcher to negotiate appropriate and relevant time schedules with the school/s and/or offices involved to conduct the research. A separate copy of this letter must be presented to both the School (both Principal and SGB) and the District/Head Office Senior Manager confirming that permission has been granted for the research to be conducted.

The following conditions apply to GDE research. The researcher may proceed with the above study subject to the conditions listed below being met. Approval may be withdrawn should any of the conditions listed below be flouted:

01/02/2021

1. *Letter that would indicate that the said researcher/s has/have been granted permission from the Gauteng Department of Education to conduct the research study.*

1

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2. *The District/Head Office Senior Manager/s must be approached separately, and in writing, for permission to involve District/Head Office Officials in the project.*
3. ***Because of COVID 19 pandemic researchers can ONLY collect data online, telephonically or may make arrangements for Zoom with the school Principal. Requests for such arrangements should be submitted to the GDE Education Research and Knowledge Management directorate. The approval letter will then indicate the type of arrangements that have been made with the school.***
4. ***The Researchers are advised to make arrangements with the schools via Fax, email or telephonically with the Principal.***
5. *A copy of this letter must be forwarded to the school principal and the chairperson of the School Governing Body (SGB) that would indicate that the researcher/s have been granted permission from the Gauteng Department of Education to conduct the research study.*
6. *A letter / document that outline the purpose of the research and the anticipated outcomes of such research must be made available to the principals, SGBs and District/Head Office Senior Managers of the schools and districts/offices concerned, respectively.*
7. *The Researcher will make every effort obtain the goodwill and co-operation of all the GDE officials, principals, and chairpersons of the SGBs, teachers and learners involved. Persons who offer their co-operation will not receive additional remuneration from the Department while those that opt not to participate will not be penalised in any way.*
8. *Research may only be conducted after school hours so that the normal school programme is not interrupted. The Principal (if at a school) and/or Director (if at a district/head office) must be consulted about an appropriate time when the researcher/s may carry out their research at the sites that they manage.*
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11. *It is the researcher's responsibility to obtain written parental consent of all learners that are expected to participate in the study.*
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13. *The names of the GDE officials, schools, principals, parents, teachers and learners that participate in the study may not appear in the research report without the written consent of each of these individuals and/or organisations.*
14. *On completion of the study the researcher/s must supply the Director: Knowledge Management & Research with one Hard Cover bound and an electronic copy of the research.*
15. *The researcher may be expected to provide short presentations on the purpose, findings and recommendations of his/her research to both GDE officials and the schools concerned.*
16. *Should the researcher have been involved with research at a school and/or a district/head office level, the Director concerned must also be supplied with a brief summary of the purpose, findings and recommendations of the research study.*

The Gauteng Department of Education wishes you well in this important undertaking and looks forward to examining the findings of your research study.

Kind regards

....

Mr Gumani Mukatuni
Acting CES: Education Research and Knowledge Management

DATE: 01/02/2021

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9.2 A2: DOCUMENTS RELATED TO INFORMED CONSENT

9.2.1 A2.1: Letter to the principal (template)

CREC Reference: 2019-CHS-0245

Department of Linguistics
PO Box 392, UNISA, 0003
Tel: 012 429 8278
schaemn@unisa.ac.za
Tel: 012 429 6045
wilseac@unisa.ac.za

<<*date*>> 2019

<<The Principal
School address line 1
School address line 2>>

Dear <<*Principal Name*>>

REQUEST FOR PERMISSION TO CONDUCT RESEARCH IN <<*name of school*>>

My name is Maxine Schaefer, and I am a PhD student and lecturer at the University of South Africa. I wish to conduct research for my Doctoral thesis on the role of phonological processing skills (i.e. phonological awareness, phonological working memory and rapid automatised naming) in the early literacy development (i.e. letter knowledge, word recognition, fluent reading, reading comprehension and spelling) of <<*(select one) isiXhosa-English/isiZulu-English*>> bilingual children. The study is a longitudinal project and will be conducted over a period of three years. In 2019, I would like to begin the project with about 85 Grade 1 learners. I would then like to work with the same group of learners when they reach Grade 2 in 2020, and Grade 3 in 2021. The assessments will always take place in the second and third term of the school year, and the participating learners will be assessed in up to four 30-minute sessions over this time. The project will be carried out under the supervision of Professor Carien Wilsenach, of the University of South Africa.

I am hereby seeking your consent to conduct the research (data collection) at your school from 2019 - 2021. I have provided you with a copy of my thesis research proposal, as well as copies of my ethical clearance letters, which contain more information about the study. If you require any further information, please do not hesitate to contact me at 012 429 8278, or **schaemn@unisa.ac.za** or my supervisor Professor Carien Wilsenach at 012 429 6045, or **wilseac@unisa.ac.za**. Thank you for your time and consideration in this matter.

Yours sincerely,

<<*signature*>>

Ms Maxine Schaefer
University of South Africa

9.2.2 A2.2: Request to participate: parents

9.2.2.1 *T1 letters provided in isiXhosa/isiZulu and English*

Le miyalelo inikezwe kuwe ngesiNgesi nesiXhosa ukwenzela ukuba uyiqondisise. Uyacelwa ukuba ugcwalise iinkcukacha kwelinye lala maphepha.

CREC Reference: 2019-CHS-0245

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Tel: 012 429 6045
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<<*date*>> 2019

Bhota Mzali/Mnakekeli

UMaxine Schaefer, ophuma kwiDyunivesithi yoMzantsi Afrika – UNISA, uza .kube esebenzisana nabafundi bebanga lokuqala <<>> ukuzama ukufunda ngolwimi nolwazi lwabantwana abancinance. Umntwana wakho umenyiwe ukuba abe yinxalenye yale nkqubo. Le nkqubo iza kuqala kwibanga lokuqala ukuya kwibanga lesithathu ukususela kunyaka wama-2019 ukuya kunyaka wama-2021. Ulwazi oluninzi luqulethwe kwiphepha elilandelayo. Emveni kokufunda ingcombolo kwiphepha elilandelayo, uyacelwa ukuba wenze u-'x' kwenye yeebhokisi ezingezantsi uphinde utyikitye ukubonakalisa ukuba uyavuma na ukuba umntwana wakho abe yinxalenye yesifundo/yophando ngonyaka wama-2019.

Umsebenzi owenziwa yiDyunivesithi awusayi konzakalisa mntwana kwaye ungasayi kuthintela inkqubela phambili yomntwana wakho esikolweni. Iinkcukacha zomntwana wakho ziza kuba yimfihlelo ukuba ngaba kukho umsebenzi othile wale nkqubo othi uxoxwe kwamanye amaqonga.

Uyacelwa ukuba ugcwalise ze ubuyisele le leta kutitshala womntwana ukuba ngaba uyavuma umntwana wakho abe yinxalenye yolu phando ngonyaka wama-2019, naxa ngaba uvuma ukuba iziphumo zisetyenziswe kuphando olufana neenkomfa kunye namaphepha ophando.

Ozithobileyo

Nkosazana Maxine Schaefer

(Umphandi)

Mna, mzali/mnakekeli ka____

(bhala igama lomntwana nefani kwesi sithuba singentla)

☐ **ndinikeza** imvume

☐ **andinikezi** mvume

yomntwana wam ukuba abe yinxalenye kuphando lwaseUNISA ngonyaka wama-2019, nokuba iziphumo zisetyenziselwe iinjongo zophando.

______________________________ __________________________

Utyikityo lomzali/umnakekeli Umhla

Uyacelwa ukuba unikezele kutitshala le leta ityikityiwe.

1

Ulwazi lomnakekeli amakalugcine

Isihloko sesifundo kunye nomphandi: Igama lam ndinguMaxine Schaefer ndiphuma kwiDynuvesithi yoMzantsi Afrika. Ndingumfundi kwaye ndingaluvuyela uncedo lomntwana wakho kwizifundo zam. Uphando lwam lubizwa ngesihloko esithi "Izakhono zokusebenzisa ubhalo-zandi nokunxibelelana kwazo ngokolwazi lolwimi lweenkobe nolwazi lolwimi olongezelelweyo phakathi kwabantwana abantetho isisiXhosa nabo bantetho isisiNgesi."

Injongo yophando: Ndizama ukufumana ukuba benza njani abantwana ukufunda ngeelwimi ezimbini. Ndimema umntwana wakho ukuba abe yinxalenye yolu phando kuba uthetha isiXhosa nesiNgesi. Olu phando lunganceda ootitshala kwiindlela ezibhetele abonokuphuchula ngazo izakhono zabafundi zokufunda nokwazi.

Iinkcukacha zokuba yinxalenye: Ukuba uyavuma ukuba umntwana wakho abe yinxalenye, uza kucelwa ukuba amamele izandi zesiNgesi nezesiXhosa. Uza kucelwa ukuba enze imisebenzi yokufunda. Imisebenzi iza kuthabatha iiyure ezimbini xa ziphelele. Siza kusebenza sonke imizuzu engamashumi amathathu kwiseshini/iziqingatha ezine apha enyakeni esikolweni. Ndiza kusebenza nomntwana wakho kwibanga lokuqala ngonyaka wama-2019, kwibanga lesibini ngonyaka wama-2020 nakwibanga lesithathu ngonyaka wama-2021. Ndiza kucela imvume kuwe rhoqo ngonyaka ukuba umntwana abe yinxalenye yophando.

Ukuzikhethela ukuba yinxalenye/ukuvolontiya: Umntwana wakho akunyanzelekanga ukuba abe yinxalenye yolu phando ukuba awunamdla wokuba abe yinxalenye yalo. Umntwana wakho angarhoxa umva nanini na efuna xa engasafuni kuba yinxalenye yophando. Umntwana wakho akayi kubasengxakini natitshala okanye nasikolo ukuba awumvumeli abe yinxalenye yolu phando. Ndiza kumbuza nomntwana wakho ukuba uyafuna na ukuba yinxalenye yolu phando.

Okuyimfihlo: Ukuba uyamvumela umntwana wakho abe yinxalenye yolu phando inkqubo yakhe kolu phando iza kugcinakala emfihlweni. Iinkcukacha zomntwana wakho ziza kwabelwa igqiza lophando, zingabelwa utitshala kuphela xa kukho uxinzelelo oluthile/ubungozi obuthile. Xa ngaba kukho iingxoxo malunga nophando lwam igama lomntwana wakho kunye negama lesikolo liza kuba yimfihlelo.

Le miyalelo inikezwe ngesiNgisi nangesiZulu ukuze kuqinisekiswe ukuthi uyayiqonda. Sicela ugcwalise ngolwazi kwelilodwa lalamafomu.

CREC Reference: 2019-CHS-0245

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wilseac@unisa.ac.za

<<*date*>> 2019

Sawubona Mzali / Mnakekeli wengane

UMaxine Schaefer, waseNyuvesi yaseNingizimu Afrika (UNISA), uzosebenza nabafundi beBanga 1 <<*School Name*>> ukufunda kabanzi ngolimi nokufunda kwezingane ezincane. Ingane yakho iyacelwa ukuba ibe yingxenye kule phrojethi. Amabanga azoba ingxenye yale phrojethi kuzosukela eBangeni 1 kuya eBangeni 3 (2019 - 2021). Kunolunye ulwazi oluningi ekhasini elilandelayo. Ngemva kokufunda ulwazi ekhasini elilandelayo, sicela ufake u-“x” kwelinye lamabhokisi angezansi uphinde usayine ukuze ubonise ukuthi uyayivumela ingane yakho ukuthi ibe ingxenye ocwaningweni ngo-2019.

Umsebenzi owenziwe iNyuvesi ngeke ulimaze ingane yakho futhi angeke uphazamise inqubekelaphambili yengane yakho esikoleni. Ulwazi ngengane yakho buzogcinwa buyimfihlo uma umsebenzi ovela kule phrojekthi uxoxwa kunoma yisiphi isithangami.

Sicela ugcwalise futhi ubuyisele le ncwadi kuthisha wengane yakho uma uyivumela ukuba ibe ingxenye yalolu cwaningo ngo-2019, futhi uma uvuma ukuthi imiphumela isetshenziselwe izinhloso zocwaningo ezifana nezinkomfa kanye nama-athikhili ejenali.

Ozithobayo

UNksz Maxine Schaefer
(Umcwaningi)

Mina, mzali / mnakekeli ka ____

(gcwalisa igama nesibongo sengane esikhaleni esingenhla)

☐ nginika imvume
☐ anginiki imvume

ukuze ingane yami ibe ingxenye ocwaningweni lwase-UNISA ngo-2019, futhi ukuze imiphumela isetshenziselwe izinhloso zocwaningo.

______________________________ ______________________________

Isiginesha Yomzali / Yomnakekeli wengane Usuku

Sicela unikeze le ncwadi esayiniwe uthisha.

Iphepha lolwazi lomnakekeli wengane okumele ulilondoloze

Isihloko socwaningo nomcwaningi: Igama lami ngu-Maxine Schaefer ngivela eNyuvesi yaseNingizimu Afrika. Ngingumfundi ngicela usizo lwengane yakho ngocwaningo lwami. Isihloko socwaningo lwami sithi "Amakhono okucubungula ifonoloji nobuhlobo bayo olimini lwasekhaya nolwengeziwe lokufunda lwesiXhosa nesiZulu ezinganeni ezilufundayo".

Inhloso yocwaningo: Ngizama ukuthola ukuthi izingane zifunda kanjani ukufunda ezilimini ezimbili. Ngimema ingane yakho ukuba ibe ingxenye yalolu cwaningo ngoba ikhuluma isiZulu nesiNgisi. Lolu cwaningo lungasiza othisha bafunde izindlela ezingcono zokusiza abafundi ukuba bathuthukise amakhono abo okufunda nokubhala.

Imininingwane yokubamba iqhaza: Uma uvumela ingane yakho ukuthi ibe ingxenye iyocelwa ukuba ilalele imisindo ngesiNgisi nangesiZulu. Izocelwa ukuba yenze imisebenzi yokufunda. Imisebenzi izothatha cishe amahora amabili seyiphelele. Sizosebenza ndawonye imizuzu engama-30 izikhawu ezine onyakeni esikoleni. Ngizosebenza nengane yakho eBangeni 1 ngo-2019, eBangeni lesi-2 ngo-2020 naseBangeni lesi-3 ngo-2021. Ngizocela imvume yakho ukuze ingane yakho ibe ingxenye ocwaningweni minyaka yonke.

Ukuzibandakanya ngokuzithandela: Ingane yakho akudingeki ibe kulolu cwaningo uma ungafuni ukuthi ibe ingxenye. Ingane yakho ingayeka ukuba ingxenye yocwaningo noma isiphi isikhathi uma ifuna. Ingane yakho ngeke ingene enkingeni kuthisha wayo noma esikoleni uma ukhetha ukungayivumeli ukuba ibe ingxenye yalolu cwaningo. Ngizophinde ngibuze ingane yakho ukuthi ngabe izimisele yini ukuba ingxenye yocwaningo.

Ubumfihlo: Uma uvumela ingane yakho ukuba ibe ingxenye yalolu cwaningo imiphumela yengane yakho ocwaningweni izogcinwa iyimfihlo. Imininingwane yengane yakho izokwabelwa abayingxenye yocwaningo, futhi inganikwa nothisha kuphela ezimweni ezithile. Lapho ucwaningo lwami seluxoxiwe ngenhloso yocwaningo igama lengane yakho negama lesikole kuzogcinwa kuyimfihlo.

These instructions have been given to you in English and isiZulu to make sure you understand. Please only complete the information in one of these forms.

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Tel: 012 429 6045
wilseac@unisa.ac.za

<<*date*>> 2019

Dear Parent/Caregiver

Maxine Schaefer, from the University of South Africa (UNISA), will be working with Grade 1 learners in <<*School Name*>> to learn more about language and literacy in young children. Your child has been invited to participate in this project. The project will last from Grade 1 to Grade 3 (2019 – 2021). There is more information on the next page. After reading the information on the next page, please place an "x" in one of the boxes below and sign to show whether you allow your child to participate in the study in 2019.

The work done by the university will not harm your child and will not influence your child's progress in school. Your child's identity will be kept confidential if work from this project is discussed in any forum.

Please complete and return this letter to your child's teacher if you allow your child to participate in the research in 2019, and if you allow for the results to be used for research purposes such as conferences and journal articles.

Kind regards

Ms Maxine Schaefer
(Researcher)

I, parent/caregiver of ____

(fill in child's name and surname in above space)

☐ give permission
☐ do not give permission

for my child to participate in the UNISA study in 2019, and for the results to be used for research purposes.

______________________________ ______________________________

Signature of Parent/Caregiver Date

Please give this signed letter back to the teacher.

3

Caregiver information sheet for you to keep

Title of the study and researcher: My name is Maxine Schaefer and I am from the University of South Africa. I am a student and I would like your child's help with my studies. My study is called "Phonological processing skills and their longitudinal relation to home and additional language literacy in isiXhosa and isiZulu speaking children".

Purpose of the study: I am trying to find out how children learn to read in two languages. I am inviting your child to participate in this study because he or she speaks <<*(select one) isiXhosa/isiZulu*>> and English. This study may help teachers learn better ways to help learners improve their literacy skills.

Details of participation: If you agree to let your child participate he or she will be asked to listen to sounds in English and in <<*(select one) isiXhosa/isiZulu*>>. He or she will also be asked to do reading activities. The activities will take about two hours in total. We will work together for 30 minutes over four sessions over the year at school. I will work with your child in Grade 1 in 2019, in Grade 2 in 2020 and in Grade 3 in 2021. I will ask for your consent for your child to take part in the study each year.

Voluntary participation: Your child does not have to be in this study if you do not want them to participate. Your child can stop participating at any time if he or she wants. Your child will not get into trouble with their teacher or school if you decide not to let your child participate in this study. I will also ask your child if he or she is willing to participate.

Confidentiality: If you allow your child to take part in the study your child's performance in my study will be kept confidential. Your child's details will be shared with the research team., and may be shared with the teacher only in extreme circumstances. When my study is discussed for research purposes the name of your child and the school's name will be kept confidential.

9.2.2.2 T3 letters provided in isiXhosa/isiZulu and English

Le miyalelo inikezwe kuwe ngesiNgesi nesiXhosa ukwenzela ukuba uyiqondisise. Uyacelwa ukuba ugcwalise iinkcukacha kwelinye lala maphepha.

CREC Reference: 2019-CHS-0245

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Tel: 012 429 6045
wilseac@unisa.ac.za

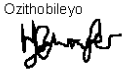
<<date>> 2021

Bhota Mzali/Mnakekeli

UMaxine Schaefer, ophuma kwiDyunivesithi yoMzantsi Afrika – UNISA, uza .kube esebenzisana nabafundi bebanga lokuqala nelesibini [redacted] ukuzama ukufunda ngolwimi nolwazi lwabantwana abancinance. Umntwana wakho umenyiwe ukuba abe yinxalenye yale nkqubo. Le nkqubo iza kuqala kwibanga lokuqala ukuya kwibanga lesithathu ukususela kunyaka wama-2019 ukuya kunyaka wama-2021. Ulwazi oluninzi luqulethwe kwiphepha elilandelayo. Nceda ujikelezele u "ewe" ukuba uyavuma ukuba umntwana wakho abe yinxalenye yophando. Nceda ujikelezele u "hayi" ukuba awumvumeli umntwana wakho abe yinxalenye yophando. Umsebenzi owenziwa yiDyunivesithi awusayi konzakalisa mntwana kwaye ungasayi kuthintela inkqubela phambili yomntwana wakho esikolweni. Iinkcukacha zomntwana wakho ziza kuba yimfihlelo ukuba ngaba kukho umsebenzi othile wale nkqubo othi uxoxwe kwamanye amaqonga.

Uyacelwa ukuba ugcwalise ze ubuyisele le leta kutitshala womntwana ukuba ngaba uyavuma umntwana wakho abe yinxalenye yolu phando ngonyaka wama-2021, naxa ngaba uvuma ukuba iziphumo zisetyenziswe kuphando olufana neenkomfa kunye namaphepha ophando. Nceda ubhale phantsi inombolo yakho yefowuni ukuze sikukhumbuze xa ngaba siza kuba sesikolweni somntwana wakho, kwaye sibuze iinkcukacha ngemvelaphi yekhaya lomntwana.

Ozithobileyo



Nkosazana Maxine Schaefer, (Umphandi)

Nceda ugcwalise ube sele ubuyisela kutitshala.

Igama nefani yomzali/yomnakekeli: ________________________________

Inombolo yefowuni yomzali/yomnakekeli: ________________________

Ingaba <<igama lomntwana>> angaba yinxalenye yophando lukaNkosazana Schaefer ngonyaka wama-2020-2021, kwaye ingaba iziphumo zingasetyenziselwa iingongo zophando? (jikelezela impendulo yakho)

EWE Umntwana wam **angaba** yinxalenye yolu phando ukuba uyavuma.
HAYI Umntwana wam **akwakwazi** kuba yinxalenye yolu phando.

________________________ ________________________
Utyikityo loMzali/Umnakekeli Umhla

1

These instructions have been given to you in English and isiXhosa to make sure you understand. Please only complete the information in one of these forms.

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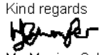
<<*date*>> 2021

Dear Parent/Caregiver

Maxine Schaefer, from the University of South Africa (UNISA), will be working with Grade 1 – 3 learners in [redacted] to learn more about language and literacy in young children. Your child has been invited to participate in this project. The project will last from Grade 1 to Grade 3 (2019 – 2021). There is more information on the next page for you to read. **Please circle "yes" if you allow your child to participate in the research. Please circle "no" if you do not allow your child to participate in the research.** The work done by the university will not harm your child and will not influence your child's progress in school. Your child's identity will be kept confidential if work from this project is discussed in any forum.

Please complete and return this letter to your child's teacher if you allow your child to participate in the research in 2021, and if you allow for the results to be used for research purposes such as conferences and journal articles. Please write down your cellphone number so we can remind you when we will be at your child's school, and ask for information about your child's home background.

Kind regards



Ms Maxine Schaefer, (Researcher)

Please complete and return to the teacher.

Parent/caregiver name and surname: ________________________________

Parent/caregiver cellphone number: ________________________

Can «Name» «Surname» be part of Ms Schaefer's research in 2020-2021, and can the results be used for research purposes? (circle your answer)

YES My child **can** be part of this research, if s/he agrees.
NO My child **cannot** be part of this research.

________________________ ________________________
Signature of Parent/Caregiver Date

2

Ulwazi lomnakekeli amakalugcine

Isihloko sesifundo kunye nomphandi: Igama lam ndinguMaxine Schaefer ndiphuma kwiDynuvesithi yoMzantsi Afrika. Ndingumfundi kwaye ndingaluvuyela uncedo lomntwana wakho kwizifundo zam. Uphando lwam lubizwa ngesihloko esithi "Izakhono zokusebenzisa ubhalo-zandi nokunxibelelana kwazo ngokolwazi lolwimi lweenkobe nolwazi lolwimi olongezelelweyo phakathi kwabantwana abantetho isisiXhosa nabo bantetho isisiNgesi."

Injongo yophando: Ndizama ukufumana ukuba benza njani abantwana ukufunda ngeelwimi ezimbini. Ndimema umntwana wakho ukuba abe yinxalenye yolu phando kuba uthetha isiXhosa nesiNgesi. Olu phando lunganceda ootitshala kwiindlela ezibhetele abonokuphuchula ngazo izakhono zabafundi zokufunda nokwazi.

Iinkcukacha zokuba yinxalenye: Ukuba uyavuma ukuba umntwana wakho abe yinxalenye, uza kucelwa ukuba amamele izandi zesiNgesi nezesiXhosa. Uza kucelwa ukuba enze imisebenzi yokufunda. Imisebenzi iza kuthabatha iiyure ezimbini xa ziphelele. Siza kusebenza sonke imizuzu engamashumi amathathu kwiseshini/iziqingatha ezine apha enyakeni esikolweni. Ndisebenzile nomntwana wakho kwibanga lokuqala ngonyaka wama-2019. Ndingathanda ukuqhubeka ndisebenze naye ngonyaka wama-2021 nokokuba ukweliphi na ibanga.

Ukuzikhethela ukuba yinxalenye/ukuvolontiya: Umntwana wakho akunyanzelekanga ukuba abe yinxalenye yolu phando ukuba awunamdla wokuba abe yinxalenye yalo. Umntwana wakho angarhoxa umva nanini na efuna xa engasafuni kuba yinxalenye yophando. Umntwana wakho akayi kubasengxakini natitshala okanye nasikolo ukuba awumvumeli abe yinxalenye yolu phando. Ndiza kumbuza nomntwana wakho ukuba uyafuna na ukuba yinxalenye yolu phando.

Okuyimfihlo: Ukuba uyamvumela umntwana wakho abe yinxalenye yolu phando inkqubo yakhe kolu phando iza kugcinakala emfihlweni. Iinkcukacha zomntwana wakho ziza kwabelwa igqiza lophando, zingabelwa utitshala kuphela xa kukho uxinzelelo oluthile/ubungozi obuthile. Xa ngaba kukho iingxoxo malunga nophando lwam igama lomntwana wakho kunye negama lesikolo liza kuba yimfihlelo.

Caregiver information sheet for you to keep

Title of the study and researcher: My name is Maxine Schaefer and I am from the University of South Africa. I am a student and I would like your child's help with my studies. My study is called "Phonological processing skills and their longitudinal relation to home and additional language literacy in isiXhosa and isiZulu speaking children".

Purpose of the study: I am trying to find out how children learn to read in two languages. I am inviting your child to participate in this study because he or she speaks isiXhosa and English. This study may help teachers learn better ways to help learners improve their literacy skills.

Details of participation: If you agree to let your child participate he or she will be asked to listen to sounds in English and in isiXhosa. He or she will also be asked to do reading activities. The activities will take about two hours in total. We will work together for 30 minutes over four sessions over the year at school. I worked with your child in Grade 1 in 2019. I would like to continue to work with him/her in 2021 in whichever grade they are in.

Voluntary participation: Your child does not have to be in this study if you do not want them to participate. Your child can stop participating at any time if he or she wants. Your child will not get into trouble with their teacher or school if you decide not to let your child participate in this study. I will also ask your child if he or she is willing to participate.

Confidentiality: If you allow your child to take part in the study your child's performance in my study will be kept confidential. Your child's details will be shared with the research team, and may be shared with the teacher only in extreme circumstances. When my study is discussed for research purposes the name of your child and the school's name will be kept confidential.

Le miyalelo inikezwe ngesiNgisi nangesiZulu ukuze kuqinisekiswe ukuthi uyayiqonda. Sicela ugcwalise ngolwazi kwelilodwa lalamafomu.

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<<date>> 2021

Sawubona Mzali/Mnakekeli wengane

UMaxine Schaefer, waseNyuvesi yaseNingizimu Afrika (UNISA), uzosebenzisana nabafundi beBanga 1 – 3 base «School» ukufunda kabanzi ngolimi nokufunda kwezingane ezincane. Ingane yakho iyacelwa ukuba ibe yingxenye kule phrojethi. Amabanga azoba ingxenye yale phrojethi kuzosukela eBangeni 1 kuya eBangeni 3 (2019 - 2021). Kunolunye ulwazi oluningi ekhasini elilandelayo. **Sicela ubhale indingilizi "yebo" uma uvumela ingane yakho ukuba ibambe iqhaza ocwaningweni. Sicela ubhale indingilizi "cha" uma ungayivumeli ingane yakho ukuthi ibambe iqhaza ocwaningweni.** Umsebenzi owenziwe iNyuvesi ngeke ulimaze ingane yakho futhi angeke uphazamise inqubekelaphambili yengane yakho esikoleni. Ulwazi ngengane yakho luzogcinwa luyimfihlo uma umsebenzi ovela kule phrojekthi uxoxwa kunoma yisiphi isithangami.

Sicela ugcwalise futhi ubuyisele le ncwadi kuthisha wengane yakho uma uyivumela ukuba ibe ingxenye yalolu cwaningo ngo2021, futhi uma uvuma ukuthi imiphumela isetshenziselwe izinhloso zocwaningo ezifana nezinkomfa kanye nama-athikhili ejenali. Uyacelwa ukuthi ubhale inombolo yakho kamakhalekhukhwini/yeselula ukuze sizokwazi ukukukhumbuza isikhathi esizofika ngaso esikoleni sengane yakho, futhi sicela ulwazi mayelana nengemuva lengane yakho.

Ozithobayo

UNksz Maxine Schaefer, (Umcwaningi)

Uyacelwa ukuba ugcwalise bese uthumela kuthisha:

Igama nesibongo somzali/mnakekeli wengane: ____________________

Inombolo kamakhalekhukhwini/yeselula yomzali/mnakekeli wengane: ____________________

Uyavuma ukuthi «Name» «Surname» abe yingxenye yocwaningo lukaNksz. Schaefer ngo-2021, futhi imiphumela ingasetshenziselwa inhloso yocwaningo? (bhala indingilizi empendulweni yakho)

YEBO Ingane yami **ingaba** ingxenye yocwaningo, uma ivuma.
CHA Ingane yami **ngeke** ibe ingxenye yocwaningo.

____________________ ____________________
Ukusayina komzali/mnakekeli wengane Usuku

1

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<<date>> 2021

Dear Parent/Caregiver

Maxine Schaefer, from the University of South Africa (UNISA), will be working with Grade 1 – 3 learners in «School» to learn more about language and literacy in young children. Your child has been invited to participate in this project. The project will last from Grade 1 to Grade 3 (2019 – 2021). There is more information on the next page for you to read. **Please circle "yes" if you allow your child to participate in the research. Please circle "no" if you do not allow your child to participate in the research.** The work done by the university will not harm your child and will not influence your child's progress in school. Your child's identity will be kept confidential if work from this project is discussed in any forum.

Please complete and return this letter to your child's teacher if you allow your child to participate in the research in2021, and if you allow for the results to be used for research purposes such as conferences and journal articles. Please write down your cellphone number so we can remind you when we will be at your child's school, and ask for information about your child's home background.

Kind regards

Ms Maxine Schaefer, (Researcher)

Please complete and return to the teacher.

Parent/caregiver name and surname: ____________________

Parent/caregiver cellphone number: ____________________

Can «Name» «Surname» be part of Ms Schaefer's research in 2021, and can the results be used for research purposes? (circle your answer)

YES My child **can** be part of this research, if s/he agrees.
NO My child **cannot** be part of this research.

____________________ ____________________
Signature of Parent/Caregiver Date

2

Iphepha lolwazi lomnakekeli wengane okumele ulilondoloze

Isihloko socwaningo nomcwaningi: Igama lami ngingu Maxine Schaefer, ngivela eNyuvesi yaseNingizimu Afrika. Ngingumfundi ocela usizo lwengane yakho ngocwaningo lwami. Isihloko socwaningo lwami sithi "Amakhono okucubungula ifonoloji nobuhlobo bayo olimini lwasekhaya nolwengeziwe lokufunda lwesiXhosa nesiZulu ezinganeni ezilukhulumayo".

Inhloso yocwaningo: Ngizama ukuthola ukuthi izingane zifunda kanjani ukufunda ezilimini ezimbili. Ngimema ingane yakho ukuba ibe ingxenye yalolu cwaningo ngoba ikhuluma isiZulu nesiNgisi. Lolu cwaningo lungasiza othisha bafunde izindlela ezingcono zokusiza abafundi ukuba bathuthukise amakhono abo okufunda nokubhala.

Imininingwane yokubamba iqhaza: Uma uvumela ingane yakho ukuthi ibe ingxenye iyocelwa ukuba ilalele imisindo ngesiNgisi nangesiZulu. Izocelwa nokuthi yenze imisebenzi yokufunda. Imisebenzi izothatha cishe amahora amabili seyiphelele. Sizosebenza ndawonye imizuzu engama-30 izikhawu ezine onyakeni esikoleni. Ngasebenza nengane yakho eBangeni 1 ngo-2019, ngingathanda ukuqhubeka ngisebenze nayo eBangeni nango-2021 noma engabe iliphi ibanga ezobe ikulo.

Ukuzibandakanya ngokuzithandela: Ingane yakho akudingeki ukuthi ibe kulolu cwaningo uma ungahambisani nokuthi ibe ingxenye. Ingane yakho ingayeka ukuba ingxenye yocwaningo noma ngasiphi isikhathi uma ifuna. Ingane yakho ngeke ingene enkingeni kuthisha wayo noma esikoleni uma ukhetha ukungayivumeli ukuba ibe ingxenye yalolu cwaningo. Ngizophinde ngibuze ingane yakho ukuthi ngabe izimisele yini ukuba ingxenye yocwaningo.

Ubumfihlo: Uma uvumela ingane yakho ukuba ibe ingxenye yalolu cwaningo imiphumela yengane yakho yocwaningo izogcinwa iyimfihlo. Imininingwane yengane yakho izokwabelwa abayingxenye yocwaningo, futhi inganikwa nothisha kuphela ezimweni ezithile. Lapho ucwaningo lwami seluxoxiwe ngenhloso yocwaningo igama lengane yakho negama lesikole kuzogcinwa kuyimfihlo.

Caregiver information sheet for you to keep

Title of the study and researcher: My name is Maxine Schaefer and I am from the University of South Africa. I am a student and I would like your child's help with my studies. My study is called "Phonological processing skills and their longitudinal relation to home and additional language literacy in isiXhosa and isiZulu speaking children".

Purpose of the study: I am trying to find out how children learn to read in two languages. I am inviting your child to participate in this study because he or she speaks isiZulu and English. This study may help teachers learn better ways to help learners improve their literacy skills.

Details of participation: If you agree to let your child participate he or she will be asked to listen to sounds in English and in isiZulu. He or she will also be asked to do reading activities. The activities will take about two hours in total. We will work together for 30 minutes over four sessions over the year at school. I worked with your child in Grade 1 in 2019. I would like to continue to work with him/her in 2020 and 2021 in whichever grade they are in.

Voluntary participation: Your child does not have to be in this study if you do not want them to participate. Your child can stop participating at any time if he or she wants. Your child will not get into trouble with their teacher or school if you decide not to let your child participate in this study. I will also ask your child if he or she is willing to participate.

Confidentiality: If you allow your child to take part in the study your child's performance in my study will be kept confidential. Your child's details will be shared with the research team, and may be shared with the teacher only in extreme circumstances. When my study is discussed for research purposes the name of your child and the school's name will be kept confidential.

9.3 A3: RESEARCH INSTRUMENTS

The research instruments I developed are also accessible at https://osf.io/gmnws/.

Standardised instruments and their adaptations are not reproduced below.

9.3.1 A3.1: Grade 1 (t1) research instruments

9.3.1.1 A3.1.1: isiXhosa

Grade 1 isiXhosa

PHONOLOGICAL PROCESSING AND LITERACY – ISIXHOSA Grade 1

Learner Unique ID:

Date of test: 2019/ /

Learner Name and Surname:

Learner is

School:

Test development: MN Schaefer and AC Wilsenach (with permission to use tests from other projects)
Translation: Mlami Diko and Siphuxolo Bikwe

Recommended Citation:
Schaefer, M. (2021, July 27). Phonological processing skills and their longitudinal relation to first and additional language literacy in isiXhosa and isiZulu speaking children. https://doi.org/10.17605/OSF.IO/GMNWS

Data capture completed 2019/ / by

Comments:

Scoring:
Correct = 1
Incorrect = 0
Nonresponse = NA

1

Verbal Assent: Siza kudlala imidlalo yezandi. Ndiza kukuxelela indlela yokudlala ngayo. Ngaba oku kulungile?

PA: Blending

Materials: audio files, headphones
Ceiling: none. Child must complete all items.
Note: the items can be repeated once only if the child asks you to
Prompt: if the child says the sounds separately (e.g. i-nj-a) and copies exactly what s/he heard, prompt by saying, ***Try to say the sounds all together as a real word*****. Zama ukuthetha izandi zonke kunye njengegama eli yinyani.** This prompt can be used as many times as needed for the examples, and once for each item.
Feedback: corrective feedback given for the example items only. Run through the examples until the child understands how the activity works. Do the second example as needed.

	Syllable Blending	
	Kulo mdlalo uza kuva iindawana ezithile zamagama, uza kuva isuntswana libe linye ngexesha. Ndifuna uphulaphulisise uze emveni koko udibanise loo masuntswana enze igama elipheleleyo. Sowulungile? Masizame elinye.	
	Ezi zandi zenza ntoni? Feedback: examples Correct: Yiyo leyo. Masizame elandelayo. Incorrect: Asiyiyo ncam leyo. Xa ubeka u-X kunye no-X zenza u-XX. Yizame, X-X zenza u___?	
E1	u – bi – si	
E2	hla – la	
Instruction: Ezi zandi zenza eliphi igama ?		SCORE
1.	khu – le – la	
2.	i – bha – na – na	
3.	i – si – fu – ba	
4.	nya – ma – la – la	
	Phoneme Blending	
	Kulungile. Mamelisisa ke ngoku. Uza kuva amanye amagama anamasuntwana ancitshiswe nangakumbi, isuntswana ngalinye ngexesha. Ndifuna umamelisise ube sele udibanisa la masuntswana enze igama elipheleleyo. Sowulungile? Masizame ibe nye.	
	Ezi zandi zenza eliphi igama? Feedback: examples Correct: Yiyo leyo. Masizame elandelayo. Incorrect: Asiyiyo ncam leyo. Xa ubeka u-X kunye no-X zenza u-XX. Yizame, X-X zenza u______?	
E3	z – a	
E4	i – f – u	
Ezi zandi zenza ntoni?		SCORE
5.	f – a	
6.	o – s – a	
7.	s – i – k – a	
8.	x – u – b – a	
9.	i – j – e – z – i	
10.	i – nk – a – w – u	

PA - Elision

Materials: none
Ceiling: none. Child must complete all items.
Note: prompt can be repeated once only per item
Feedback: corrective feedback given for the example items only. Run through the examples until the child understands how the activity works. Do the second example as needed.

	Syllable Elision			
	Masidlale umdlalo wegama. Yithi "......". Yithi ke ngoku "........" ungambizanga u- ".......". e.g. Yithi "vuya" Yithi ke ngoku "vuya" ungambizanga u- "vu".			
	Feedback: examples Correct: Yiyo leyo. Masizame elandelayo. Incorrect: Asiyiyo ncam leyo. U-vuya ungambizanga u-vu ngu-ya.			
	Yithi	*ungambizanga u*	*Answer*	
E5	vuya	vu	ya	
E6	sebenza	nza	sebe	
	Yithi	*ungambizanga u-*	*Answer*	SCORE
11.	baleka	ba	leka	
12.	sondela	so	ndela	
13.	isifo	fo	isi	
14.	indaba	ba	inda	
15.	usiba	si	uba	
16.	phawula	wu	phala	
	Phoneme Elision			
	Kulungile. Ngoku ke masizame amanye apho sisusa amasuntswana athile amagama. Yithi "......". Yithi ke ngoku "........"ungambizanga u ".......". Ngoku sizakususa iindawana ezizi ncinci ekuqaleni kwegama, uze undixelele okuseleyo egameni elo. e.g. Yithi "iculo" Yithi ke ngoku "iculo" ungamibanga u- "i".			
	Feedback: examples Correct: Kulungile. Ake sizame elilandelayo. Incorrect: Lokhu akulona iqiniso. U-*iculo* ngaphandle kuka-*"i"* ungu-*"culo"*.			
	Yithi	ungambizanga u	*Answer*	
E7	iculo	i	culo	
E8	nika	n	ika	
	Yithi	ungambizanga u	*Answer*	SCORE
17.	ikati	i	kati	
18.	bona	b	ona	
19.	mela	m	ela	
20.	linga	l	inga	

PA - Isolation

Materials: none
Ceiling: none. Child must complete all items.
Note: prompt can be repeated once only per item
Feedback: corrective feedback given for the example items only. Run through the examples until the child understands how the activity works. Do the second example as needed.

	Phoneme Isolation		
	Ngoku siza kudlala umdlalo wamagama apho ndiza kukucela ubize amasuntswana athile amagama. Siza kusebenzisa ezi ziciko zebhotile ukuze zisincedise.		
	Feedback: examples Correct: Yiyo leyo. Isandi sokuqala ku"na" ngu-/n/. Incorrect: Asiyiyo ncam. Isandi sokuqala ku-"na" ngu-/n/. No response: Isandi sokuqala ku-"na" ngu-/n/.		
E9	Igama elithi "na" linezandi ezimbini. / n / / a /. sesiphi isandi sokuqala sokuthi "na"?	/n/	
E10	Igama elithi "indlu" linezandi ezintathu / i / / ndl / / u /. Sesiphii isandi sokugqibela – sokuthi "indlu"	/u/	
	Instructions	*Answer*	SCORE
21.	Igama elithi "ma" linezandi ezimbini. / m / / a /. Sesiphi isandi sokuqala sokuthi "ma"?	/m/	
22.	Igama elithi "ona" linezandi ezintathu / o / / n / / a /. Sesiphi isandi sokugqibela sokuthi "ona"	*/a/*	
23.	Igama elithi "apha" linezandi ezintathu. / i / / nj / / a /. Sesiphi isandi esiphakathi sokuthi "inja"?	*/nj/*	
24.	Igama elithi "ipali" linezandi ezintlanu kulo. / i / / p / / a / / l / / i /. Sesiphi isandi sesibini sokuthi "ipali"?	*/p/*	
25.	Igama elithi "vuka" linezandi ezine kulo. / v / / u / / k / / a /. Sesiphi isandi sesibini sokuthi "vuka"?	*/u/*	

Comments:

Verbal Assent: Siza kumamela izandi ezithile size siziphinde. Ingaba kulungile oko?

PWM - Digit Span

Materials: computer to play recorded digit span items
Ceiling: **stop** after child gets **3 items incorrect consecutively**
Feedback: feedback given only for examples. Do both examples.
Scoring: score 1 point for each test trial completed without error (all numbers must be said in the correct order).
Note: if child asks to have an item repeated say, **Ndiyakwazi ukudlala izandi ezirekhodiweyo kanye kuphela.**

Instructions for learner		
Ask the child to count to 6 in their L1. If they cannot count to six, then do not administer the task. **Uyacelwa ukuba ubale ukusuka kwisinye ukuya kwisithandathu ngesiXhosa.**		
26. *Can child count to 6 in L1? (circle appropriate answer)*	*Yes = continue*	*No = stop*
Ndiza kukucela ukuba unxibe ezi hedifoni ukuze umamele uqophelo olusekhompyutheni yam. Uza kuva amanani athile, elinye emveni kwelinye. Emveni kokuba uve amanani, ndifuna uwabize ngokulandelelana kwawo ngalaa ndlela uweve ebizwa ngayo. Mamelisisa kuba andizokuwaphinda amanani. Masizame amanye okuziqhelanisa. *Play the audio files, pausing after each trial to allow the child to respond. Provide feedback for examples only.*		

Item	Digits	SCORE
E11	5 2	
E12	5 1 4	
27.	6 1	
28.	2 5	
29.	1 4	
30.	5 3 1	
31.	6 2 4	
32.	4 1 6	

Item	Digits	SCORE
33.	5 3 1 4	
34.	3 5 2 6	
35.	2 5 1 6	
36.	4 1 6 3 5	
37.	6 3 2 5 1	
38.	5 2 4 6 3	
39.	3 1 4 6 5 2	
40.	4 6 1 3 5 2	
41.	4 3 6 2 5 1	

PWM – Non word Repetition

Materials: computer to play recorded nonword items
Ceiling: **stop** after child gets **3 items incorrect consecutively**
Feedback: feedback given only for examples
Scoring: score 1 point for each test trial completed without error (all nonwords must be said exactly the same as the prompt).
Note: if child asks to have an item repeated say, **Ndiyakwazi ukudlala izandi ezirekhodiweyo kanye kuphela.**

Instructions for learner
Ndifuna umamele amanye amagama enziweyo, emveni kokuba uve igama ngalinye elenziweyo ndifuna ulibize ngqo ngale ndlela ulive ngayo ngokuc acileyo . **Nokuba kunzima ukulibiza , zama kangangoko unako. Mamelisisa kuba andizokuwaphinda amagama. Masizame amanye.** *Play the CD, pausing after each trial to allow the child to respond. Provide feedback for examples only* *If correct:* **Ewe, ilungile.** *If incorrect:* **Asiyiyo ncam. Igama ibingu-__________. Masizame elinye.**

	Nonword	Score
E15	cikofe	
E16	pelazane	
42.	yemodo	
43.	baluki	
44.	fitshuli	
45.	lutsibadu	
46.	hlivejuno	
47.	gomvenizi	
48.	zatilayishi	
49.	bontukazeva	

	Nonword	Score
50.	dlimadwifi	
51.	mogosidoletha	
52.	wintenalwagiye	
53.	zutugoxongcida	
54.	nayulongwakhubazi	
55.	shwenzifesangenoda	
56.	modwitshaqokhemasho	
57.	niconzomethazumbosha	
58.	hlevashaniqobutenti	
59.	kolohlawezatasafi	

Verbal Assent: Siza kudlala umdlalo apho kufuneka ubize amagama ezinto/imibala/oonobumba/amanani ukhawulezisa kangangoko unako. Ingaba kulungile?

RAN - objects[i]

Materials: object naming chart, stopwatch
Ceiling: discontinue only if child is unable to do the task
Scoring: the score for this subtest is the number of seconds that it takes the examinee to name all of the objects on the form. Items are marked incorrect if the child skips the object or gives it the wrong name. If the child skips a line, score the first object on the skipped line as incorrect and try to redirect the child to the correct line. If the child hesitates for more than 2 seconds on an object, mark it as incorrect and point to the next item and say, **Qhubeka**.

Instructions for learner:
Show practice page (chart 1.1.) and say, **Ziintoni ozibona kweli phepha?** *(point to first object and continue pointing if necessary. If the child makes any errors, correct the child, and have him/her repeat all the objects again. inkwenkwezi, isandla, itafile, inja, incwadi, ilanga) Say,* **Uza kubiza amagama ezinto ozibonayo ukhawulezisa kangangoko unako.** *Show the next page (chart 1.2.) and say,* **Masiyizame. Xa ndisithi qalisa, uza kuqala apha, ubize amagama ezinto ezi kule rowu ngaphambi ngokuba udlulele kwelandelayo. Biza igama le nto ekwirowu nganye ukhawulezisa kangangoko unako de uyofika ekugqibeleni. Zama ukuba ungatsibi nanye into. Uyaqonda?** *Put a blank sheet on top of the form to cover the objects for about 5 seconds. Say,* **Uza kuqalisa xa ndityhila iphepha. Sowulungile? Qalisa.** *Quickly take cover off the page, and start timing as soon as the child says the first object's name. Stop timing when the name of the last object is pronounced. Keep track of errors by putting a slash through each wrong item. When the child is finished, record time and errors.*

SCORING – RAN objects			
60. **number of errors**		61. **total time taken**	

RAN - letters[i]

Materials: letter naming chart, stopwatch
Ceiling: discontinue only if child is unable to do the task
Scoring: the score for this subtest is the number of seconds that it takes the examinee to say the sounds of the letters on the form. Items are marked incorrect if the child skips the letter or gives it the wrong sound. If the child skips a line, score the first letter on the skipped line as incorrect and try to redirect the child to the correct line. If the child hesitates for more than 2 seconds on a letter, mark it as incorrect and point to the next item and say, **Qhubeka.**

Instructions for learner
Show practice page (chart 2.1.) and say, **Ngabaphi oonobumba obabonayo kweli phepha? Sesiphi isandi esenziwa ngunobumba ngamnye?** *(point to first colour and continue pointing if necessary. If the child makes any errors, correct the child, and have him repeat all the colours again.) Say,* **Uza kube ubiza izandi zabanye oonobumba ukhawulezisa kangangoko unako.** *Show the next page (chart 2.2.) and say*, **Masiyizame. Xa ndisithi qalisa, uza kuqalisa apha ubize izandi zaba nobumba bakule rowu ngaphambi kokuba udlulele kwirowu elandelayo. Vele ubize izandi zoonobumba kwirowu nganye ukhawulezisa kangangoko unako de uyofika ekugqibeleni. Zama ukuba ungatsibi nomnye unobumba. Uyaqonda?** *Put a blank sheet on top of the form to cover the letters for about 5 seconds. Say,* **Uza kuqalisa xa ndityhila iphepha. Sowulungile? Qalisa.** *Quickly take cover off the page, and start timing as soon as the child says the first letter's sound. Stop timing when the name of the last number is pronounced. Keep track of errors by putting a slash through each wrong item. When the child is finished, record time and errors.*

Chart 2.2.

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

SCORING – RAN letters			
62. Discontinued at practice: Child does not know letters			
63. number of errors		64. total time taken	

Verbal Assent: Ndiza kukucela ukuba ufunde ke ngoku. Ingaba kulungile?

Literacy: letter sound recognition

60s

Instructions for learner
Place chart 3 in front of the learner **Ndiza kukucela ukuba undifundele abanye boonobumba besiXhosa. Ndicela undixelele ukuba unobumba ngamnye umele esiphi isandi. Ndicela ufunde oonobumba abaninzi kangangoko unako ukusuka ekhohlo ukuya ngasekunene ngokwalo mzekelo** (show example)**. Ndiza kukuxelela ukuba yima nini.** **Sowulungile?** **Qalisa.** *Start timer (one minute) when you say start.* • ***Circle*** *the* ***last*** *letter read when the time ran out.* • *Place a* ***diagonal*** *line through the letters which are read* ***incorrectly****.* • ***CEILING:*** *Stop the task if the child makes* ***5 consecutive errors***

Chart 3

m	l	h	g	S	y	Z	W	p	n	10
L	th	T	c	B	a	hl	o	n	ng	20
i	b	th	M	U	sh	j	dl	K	u	30
g	R	B	kh	L	f	hl	M	s	kw	40
S	N	ph	B	P	v	k	a	E	D	50
R	A	t	P	F	sh	h	u	a	t	60
dw	G	H	B	S	l	g	m	i	j	70
B	dl	o	m	O	Y	E	N	p	t	80
g	K	B	ny	Y	bh	Z	V	D	nc	90
f	s	ng	a	Z	p	C	th	G	sw	100
V	ncw	q	h	Nhl	g	sh	y	kh	t	110

SCORING – letter sound recognition			
65. **Task discontinued**		66. **Number of errors**	
67. **Number of letters attempted**		68. **Time remaining**	

Literacy: word reading fluency

Instructions for learner
Place chart 4 in front of learner. **Ndicela ufunde la magama ngokuvakalayo. Ndiza kukuxelela ukuba yima nini. Sowulungile? Qalisa.** • Record the total time taken to complete the task. Start the timer when you say start. • Indicate errors by placing a diagonal line through the word. • ***CEILING:*** *Stop the task if the child makes* ***5 consecutive errors and circle last item read.***

Chart 4

ya	abo	into	lala	beka
igama	amanzi	imoto	phuma	funa
vula	mela	usana	unyawo	wela
thwala	uthuli	intombazana	ufudo	usiba

SCORING – word reading fluency			
69. **Task discontinued**			
70. **number of errors**		71. **total time taken**	

Literacy: oral reading fluency[ii]

60s

Instructions for learner:
Place chart 5 in front of the learner **Ndiza kukucela ukuba undifundele ibali ngokuvakalayo. Fundisisa kangangoko unako.** **Eli bali libizwa ngokuba ngu-"Jabu nenja yakhe"** **Sowukulungele ukufunda ibali ngokuvakalayo? Ndiza kukuxelela ukuba yeka nini ukufunda.** **Qalisa.** *Start timer when you say start. Record the incorrectly read words by placing a diagonal line through them. Circle the last word attempted when the time ran out.* ***Discontinue if child cannot read first five words.***

Chart 5

isiXhosa: Ujabu nenja yakhe	Cum total
UJabu wayenenja encinane.	3
Ngenye imini uJabu nenja yakhe bayakudlala kwibala elalisemva kwendlu.	12
Injana yabona umvundla yazama ukuwuleqa.	17
Yalahleka inja.	19
Wabangayibiza uJabu kodwa ayizange ibuye.	24
UJabu wabonakala eneenyembezi emehlweni akhe waza wagoduka.	31
Kodwa kwathi phambi kwangorhatya yabuya injana.	37
Yayidiniwe, ilambile.	39
Wavuya kakhulu uJabu akumbona umhlobo wakhe.	45
UJabu wa yinika ukutya namanzi inja.	50
UJabu nenja yakhe baya kulala.	55

SCORING – oral reading fluency			
72. **Task discontinued**		73. **Number of errors**	
74. **Number of words attempted**		75. **Time remaining**	

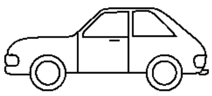
Literacy: early writing and spelling

Instructions for learner.
Ndiza kukucela ukuba undibhalele ke ngoku. Ndicela ubhale igama nefani yakho kwesi siqwengana sephepha. *Place the page in front of the learner and show him/her where to start writing.*
Once the learner has completed their name show them the picture of the "car" and say, **Yintoni le? Ewe, yi-"moto". Bhala phantsi igama "imoto" apha.** *(indicate on the piece of paper where the learners should write "imoto"). Cover this part of the page when the learner is writing.*

SCORING – name writing			
76. name spelled correctly		77. surname spelled correctly	

SCORING – imoto	
78. correct:	
79. _i	
80. im	
81. mo	
82. ot	
83. to	
84. o_	

igama



[i] RAN objects and RAN letters tasks used with permission from Second Early Grade Reading Study Grade 2 Learner Assessment (USAID/Department of Basic Education, 2018)

[ii] ORF test used with permission from ERA. The ERA Xhosa literacy tests were adapted and modified from the original Xhosa EGRA tests received from the EC provincial department of Basic Education. Funded by Zenex, Dr Lauren Wildschut from ERA and Prof EJ Pretorius from Unisa adapted, piloted and revised the original EGRA assessments during 2015-2016.

9.3.1.2 A2.1.2: isiZulu

PHONOLOGICAL PROCESSING AND LITERACY – ISIZULU Grade 1

Learner Unique ID:

Date of test: 2019/ /

Learner Name and Surname:

Learner is

School:

Test development: MN Schaefer and AC Wilsenach (with permission to use tests from other projects)

Translation: Celani Zwane and Nthabiseng Tsotetsi

Recommended Citation:

Schaefer, M. (2021, July 27). Phonological processing skills and their longitudinal relation to first and additional language literacy in isiXhosa and isiZulu speaking children. https://doi.org/10.17605/OSF.IO/GMNWS

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Data capture completed 2019/ / **by**

Comments:

Scoring:
Correct = 1
Incorrect = 0
Nonresponse = NA

Verbal Assent: Sizobe sidlale imidlalo emisindo manje. Ngizokutshela ukuthi ungadlala kanjani. Ingabe lokhu kulungile?

PA: Blending

Materials: audio files, headphones
Ceiling: none. Child must complete all items.
Note: the items can be repeated once only if the child asks you to
Prompt: if the child says the sounds separately (e.g. i-nj-a) and copies exactly what s/he heard, prompt by saying, ***Try to say the sounds all together as a real word.*** **Zama ukusho imisindo yonke njengezwi langempela.** This prompt can be used as many times as needed for the examples, and once for each item.
Feedback: corrective feedback given for the example items only. Run through the examples until the child understands how the activity works. Do the second example as needed.

	Syllable Blending	
	Kulo mdlalo, ngizobiza igama ngezinxenye ezihlukene, ezincane, ingxenye eyodwa ngesikhathi. Ngifuna ulalele ngokucophelela bese uhlanganisa lezi zingxenye ndawonye ukuze wenze igama eliphelele. Ukulungele? Ake sizame elilodwa.	
	Yiliphi igama elenziwa ile misindo? Feedback: examples Correct: Ake sizame okulandelayo. Incorrect: Lokhu akulona iqiniso. Uma ufaka u-x no-x ndawonye kwenza u-xx. Zama u-x-x kwenza _____? Ake sizame okulandelayo.	
E1	u – bi - si	
E2	hla – la	
Instruction: Yiliphi igama elenziwa ile misindo?		SCORE
1.	khu – le – la	
2.	u – bha – na – na	
3.	i – si – fu – ba	
4.	nya – ma – la – la	
	Phoneme Blending	
	Kulungile. Lalela ngokucophelela manje. Manje ngizophimisa izinxenye ezihlukene ezenza igama elilodwa, ingxenye eyodwa ngesikhathi. Ngifuna ulalele ngokucophelela bese ubeka lezi zingxenye ndawonye/uhlanganisa lezi zinxenye ukuze wenze igama eliphelele. Ukulungele? Ake sizame elilodwa.	
	Yiliphi igama elenziwa ile misindo? Feedback: examples Correct: Ake sizame okulandelayo. Incorrect: Lokhu akulona iqiniso. Uma ufaka u-x no-x ndawonye kwenza u-xx. Zama u-x-x kwenza _____? Ake sizame okulandelayo.	
E3	z – a	
E4	i – f – u	
Yiliphi igama elenziwa ile misindo?		SCORE
5.	f – a	
6.	o – s – a	
7.	s – i – k – a	
8.	x – u – b – a	
9.	i – j – e – z – i	
10.	i – nk – a – w – u	

PA - Elision

Materials: none
Ceiling: none. Child must complete all items.
Note: prompt can be repeated once only per item
Feedback: corrective feedback given for the example items only. Run through the examples until the child understands how the activity works. Do the second example as needed.

	Syllable Elision			
	Masidlale umdlalo wegama. Yisho "....." Manje yithi "......"ungambizanga u-"....". Sizoqala ngokusho igama eliphelele bese silandela ngokulisho sikhiphe ingxenye ethile yalo, yithi "vuya", uma ususa "vu" yisho ukuthi kusala ubani? e.g. Yisho "vuya" Manje yithi "vuya" ungambizanga u-"ya".			
	Feedback: examples Correct: Kulungile. Ake sizame elilandelayo. Incorrect: Lokhu akulona iqiniso. U-*vuya* ungambizanga u-*vu* ungu-*ya*.			
	Yithi	ungambizanga u-	*Answer*	
E5	vuya	vu	ya	
E6	sebenza	nza	sebe	
	Yithi	*ungambizanga u-*	*Answer*	SCORE
11.	baleka	ba	leka	
12.	sondela	so	ndela	
13.	isifo	fo	isi	
14.	indaba	ba	inda	
15.	usiba	si	uba	
16.	phawula	wu	phala	
	Phoneme Elision			
	Kulungile. Manje ake sizame lapho sithatha khona izingxenye ezincane zamagama. Yisho ".....". Manje yithi "......."ungambizanga u "...". Manje sizosusa ingxenye encane ekuqaleni kwegama bese wena usho ukuthi ithini ingxenye yegama esele egameni. e.g. Yisho "iculo". Yithi "iculo" ungambizanga u -"i".			
	Feedback: examples Correct: Kulungile. Ake sizame elilandelayo. Incorrect: Lokhu akulona iqiniso. U-*iculo* ngaphandle kuka-*"i"* ungu-*"culo".*			
	Yithi	ungambizanga u	*Answer*	
E7	iculo	i	culo	
E8	nika	n	ika	
	Yithi	ungambizanga u	*Answer*	SCORE
17.	ikati	i	kati	
18.	bona	b	ona	
19.	mela	m	ela	
20.	linga	l	inga	

PA - Isolation

Materials: none
Ceiling: none. Child must complete all items.
Note: prompt can be repeated once only per item
Feedback: corrective feedback given for the example items only. Run through the examples until the child understands how the activity works. Do the second example as needed.

	Phoneme Isolation		
	Manje sizokwenza umdlalo wegama lapho ngizokucela ukuba usho izingxenye zamagama. Ngizobiza imisindo yegama elilodwa bese ngikubuza imibuzo ngaleyo misindo.		
	Feedback: examples Correct: Kulungile. Umsindo wokuqala "na" u- /n/. Incorrect: Lokhu akulona iqiniso. Umsindo wokuqala "na" u- /n/. No response: Umsindo wokuqala "na" u/n/.		
E9	Igama elithi "na" linemisindo emibili . / n / / a /. yimuphi/uthini umusindo wokuqala egameni elithi "na"?	/n/	
E10	Igama elithi "indlu linemisindo emithathu / i / / ndl / / u /. yimuphi/uthini umsindo osekugcineni egameni elithi "indlu"? -	/u/	
	Instructions	*Answer*	SCORE
21.	Igama elithi "ma" linemisindo emibili. / m / / a /. yimuphi/uthini umsindo wokuqala egameni elithi "ma"?	/m/	
22.	Igama elithi "ona" linemisindo emithathu / o / / n / / a /. –yimuphi/uthini umsindo wokugcina egameni elithi "ona"?	*/a/*	
23.	Igama "inja" linemisindo emithathu. /i/ /nj/ /a/. yimuphi/uthini umsindo ophakathi egameni elithi "inja"?	*/nj/*	
24.	Igama elithi "ipali" linemisindo emihlanu kulo. / i / / p / / a / / l / / i /. yimuphi/uthini umsindo wesibili egameni elithi "ipali"?	*/p/*	
25.	Igama elithi "vuka" linemisindo emine kulo. / v / / u / / k / / a /. yimuphi/uthini umsindo wesibili egameni elithi "vuka"?	*/u/*	

Comments:

Verbal Assent: Sizolalela imisindo ethile bese siyiphinda. Ingabe lokhu kulungile?

PWM - Digit Span

Materials: computer to play recorded digit span items
Ceiling: **stop** after child gets **3 items incorrect consecutively**
Feedback: feedback given only for examples. Do both examples.
Scoring: score 1 point for each test trial completed without error (all numbers must be said in the correct order).
Note: if child asks to have an item repeated say, **Ngingadlala kuphela imisindo eqoshiwe kanye.**

Instructions for learner		
Ask the child to count to 6 in their L1. If they cannot count to six, then do not administer the task. **Kulomdlalo ngizocela ubale kusuka kokunye kuze kufike kokuyisithupha.**		
26. Can child count to 6 in L1? (circle appropriate answer)	*Yes = continue*	*No = stop*
Manje ngizokucela ukuthi ugqoke okokulalela ezindlebeni ukuze ulalele lokhu okurikhodwe kwikhompyutha yami. Uzozwa izinombolo ezithile, ngokulandelana. Emva kokuzwa izinombolo, ngifuna ukuthi uzisho ngendlela ezilandelana ngayo. Lalela ngokucophelela ngoba angikwazi ukuphinda izinombolo. Ake sizame izibonelo ukuze siziqeqeshe. *Play the CD, pausing after each trial to allow the child to respond. Provide feedback for examples only.*		

Item	Digits	SCORE
E11	5 2	
E12	5 1 4	
27.	6 1	
28.	2 5	
29.	1 4	
30.	5 3 1	
31.	6 2 4	
32.	4 1 6	

Item	Digits	SCORE
33.	5 3 1 4	
34.	3 5 2 6	
35.	2 5 1 6	
36.	4 1 6 3 5	
37.	6 3 2 5 1	
38.	5 2 4 6 3	
39.	3 1 4 6 5 2	
40.	4 6 1 3 5 2	
41.	4 3 6 2 5 1	

PWM – Non word Repetition

Materials: computer to play recorded nonword items
Ceiling: **stop** after child gets **3 items incorrect consecutively**
Feedback: feedback given only for examples
Scoring: score 1 point for each test trial completed without error (all nonwords must be said in the correct order).
Note: if child asks to have an item repeated say, **Ngingadlala kuphela imisindo eqoshiwe kanye.**

Instructions for learner
Ngifuna ukuthi ulalele lamagama akhiwe; emva kokuthi uzwe ngalinye igama elakhiwe ngifuna ukuthi usho kahle njengoba uzwile futhi ngokucacile ngendlela ongakwazi ukusho ngayo. Ngisho noma kunzima ukusho, zinike ithuba elenele lokuzama. Lalela ngokucophelela ngoba angikwazi ukuphinda amagama. Kulungile? Ake sizame lawa alandelayo. *Play the CD, pausing after each trial to allow the child to respond. Provide feedback for examples only.* *Feedback* *If correct:* **Yebo, kunjalo.** *If incorrect:* **lokho akulona iqiniso. Igama olizwile lithi ________. Ake sizame elinye.**

	Nonword	Score
E15	cikofe	
E16	pelazane	
42.	yemodo	
43.	fitshuli	
44.	baluki	
45.	lutsibadu	
46.	hlivejuno	
47.	gomvenizi	
48.	zatilayishi	
49.	bontukazeva	

	Nonword	Score
50.	dlimadwifi	
51.	mogosidoletha	
52.	wintenalwagiye	
53.	zutugoxongcida	
54.	nayulongwakhubazi	
55.	shwenzifesangenoda	
56.	modwitshaqokhemasho	
57.	niconzomethazumbosha	
58.	hlevashaniqobutenti	
59.	kolohlawezatasafi	

Verbal Assent: Sizobe sidlala umdlalo lapho kufanele usho amagama alezi zinto ezilandelayo / imibala / izinhlamvu / izinombolo ngokushesha ongakukhona. Ingabe lokhu kulungile?

RAN - objects[i]

Materials: object naming chart, stopwatch
Ceiling: discontinue only if child is unable to do the task
Scoring: the score for this subtest is the number of seconds that it takes the examinee to name all of the objects on the form. Items are marked incorrect if the child skips the object or gives it the wrong name. If the child skips a line, score the first object on the skipped line as incorrect and try to redirect the child to the correct line. If the child hesitates for more than 2 seconds on an object, mark it as incorrect and point to the next item and say, **Qhubeka**.

Instructions for learner:

Show practice page (chart 1.1.) and say, **Yiziphi izinto ozibonayo kuleli khasi** *(point to first object and continue pointing if necessary. If the child makes any errors, correct the child, and have him/her repeat all the objects again. Inkanyezi, isandla, itafula, inja, incwadi, ilanga) Say,* **Uzobe usho amagama alezi zinto ozibonayo ngendlela ongashesha ngayo.**

Show the next page (chart 1.2.) and say, **Ake sizame. Uma ngikutshela ukuthi uqale, uzoqala lapha** *(point to upper left corner)* **bese ubiza le rowu** *(point to top row)* **ngaphambi kokuya erowini elandelayo** *(move your finger to the next row).* **Yisho nje izinto erowini ngayinye ngokushesha ongakwazi kuze kube sekugcineni. Zama ukungeqi noma iyiphi irowu. Uyaqonda?**

Put a blank sheet on top of the form to cover the objects for about 5 seconds. Say, **Uzoqala ngokushesha nje lapho ngimbula leli khasi. Ukulungele? Qala.**

Quickly take cover off the page, and start timing as soon as the child says the first object's name. Stop timing when the name of the last object is pronounced. Keep track of errors by putting a slash through each wrong item. When the child is finished, record time and errors.

SCORING – RAN objects			
60. **number of errors**		61. **total time taken**	

RAN - letters[i]

Materials: letter naming chart, stopwatch
Ceiling: discontinue only if child is unable to do the task
Scoring: the score for this subtest is the number of seconds that it takes the examinee to say the sounds of the letters on the form. Items are marked incorrect if the child skips the letter or gives it the wrong sound. If the child skips a line, score the first letter on the skipped line as incorrect and try to redirect the child to the correct line. If the child hesitates for more than 2 seconds on a letter, mark it as incorrect and point to the next item and say, **Qhubeka.**

Instructions for learner
Show practice page (chart 2.1.) and say, **Yiziphi izinhlamvu ozibonayo kuleli khasi? Yimuphi umsindo ngalinye eliwenzayo?** *(point to first colour and continue pointing if necessary. If the child makes any errors, correct the child, and have him repeat all the colours again.) Say,* **Uzobe ususho umsindo wezinye izinhlamvu ngokushesha ongakwazi.** *Show the next page (chart 2.2.) and say*, **Ake sizame. Uma ngikutshela ukuthi qala, uzoqala lapha** *(point to upper left corner)* **bese usho imisindo yalezi zinhlamvu kule rowu** *(point to top row)* **ngaphambi kokuya erowini elandelayo** *(move your finger to the next row).* **kumele usho umsindo wezinhlamvu erowini ngayinye ngokushesha ongakwazi uze ufike ekugcineni. Zama ukungatholi noma yiziphi izinhlamvu. Ingabe uyezwa?** *Put a blank sheet on top of the form to cover the letters for about 5 seconds. Say,* **Uzoqala ngokushesha nje lapho ngivula leli khasi. Ukulungele? Qala.** *Quickly take cover off the page, and start timing as soon as the child says the first letter's sound. Stop timing when the name of the last number is pronounced. Keep track of errors by putting a slash through each wrong item. When the child is finished, record time and errors.*

Chart 2.2.

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

SCORING – RAN letters			
62. Discontinued at practice: Child does not know letters			
63. number of errors		64. total time taken	

Verbal Assent: Ngizokucela ukuthi ufunde manje. Ingabe lokhu kulungile?

Literacy: letter sound recognition

60s

Instructions for learner
Place chart 3 in front of the learner

Ngizokucela ukuthi ungifundele izinhlamvu ezithile zesiZulu. Ngitshele ukuthi uhlamvu ngalunye lwenza muphi umsindo. Funda izinhlamvu eziningi ukusukela kwesokunxele kuya kwesokudla njengakulesi sibonelo (show example)**. Ngizokutshela ukuthi ume.**

Ingabe usulungile?

Qala.

Start timer (one minute) when you say start.

- ***Circle** the **last** letter read when the time ran out.*
- *Place a **diagonal** line through the letters which are read **incorrectly**.*
- ***CEILING:** Stop the task if the child makes **5 consecutive errors***

Chart 3

m	l	h	g	S	y	Z	W	p	n	10
L	th	T	c	b	a	hl	o	n	ng	20
i	b	th	M	U	sh	j	dl	K	u	30
g	R	B	kh	l	f	hl	M	s	kw	40
S	N	ph	B	p	v	k	a	E	D	50
R	A	t	P	f	sh	h	u	a	t	60
dw	G	H	B	S	l	g	m	i	j	70
B	dl	o	m	O	Y	E	N	p	t	80
g	K	B	ny	y	bh	Z	V	D	nc	90
f	s	ng	a	z	p	C	th	G	sw	100
V	ncw	q	h	nhl	g	sh	y	kh	t	110

SCORING – letter sound recognition			
65. **Task discontinued**		66. **Number of errors**	
67. **Number of letters attempted**		68. **Time remaining**	

Literacy: word reading fluency

Instructions for learner
Place chart 4 in front of learner.

Sicela ufunde la magama ngokuzwakalayo ngokusemandleni akho. Ngizokutshela ukuthi yima. Usukulungele? Qala.

- Record the total time taken to complete the task. Start the timer when you say start.
- Indicate errors by placing a diagonal line through the word.
- ***CEILING:** Stop the task if the child makes **5 consecutive errors and circle last item read.***

Chart 4

ya	abo	into	lala	beka
igama	amanzi	imoto	phuma	funa
vula	mela	usana	unyawo	wela
thwala	uthuli	intombazana	ufudo	usiba

SCORING – word reading fluency			
69. **Task discontinued**			
70. **number of errors**		71. **total time taken**	

Literacy: oral reading fluency[ii]

60s

Instructions for learner:
Place chart 5 in front of the learner **Ngizokucela ukuthi ungifundele indaba ngezwi eliphezulu. Funda ngokwekhono lakho.** **Le indaba ethi "UJabu nenja yakhe"** **Ingabe usukulungele ukungifundela indaba ngezwi eliphezulu? Ngizokutshela ukuthi ume.** **Qala.** *Start timer when you say start. Record the incorrectly read words by placing a diagonal line through them. Circle the last word attempted when the time ran out.* ***Discontinue if child cannot read first five words.***

Chart 5

isiZulu: Ujabu nenja yakhe	Cum total
UJabu wayenenja encane.	3
Kwakuyinja ekhuluphele futhi ejabulile.	7
Ngelinye ilanga uJabu nenja yakhe baya ukuyodlala enkundleni engemuva komuzi.	17
Inja yabona unogwaja yase iyawujaha.	22
Inja yalahleka.	24
UJabu wayimemeza kodwa yangabuya.	28
UJabu wagcwala izinyembezi emehlweni akhe wase ephindela ekhaya.	36
Kodwa kwathi ngaphambi kokushona kwelanga inja yabuya.	43
Yayikhathele futhi ilambile.	46
UJabu wajabula ukubona umngani wakhe.	51
UJabu wanika inja ukudla namanzi.	56

SCORING – oral reading fluency			
72. **Task discontinued**		73. **Number of errors**	
74. **Number of words attempted**		75. **Time remaining**	

Literacy: early writing and spelling

Instructions for learner.
Ngizocela ukuthi ungibhalele okuthile manje. Ngicela ubhale igama lakho nesibongo kuleli phepha. *Place the page in front of the learner and show him/her where to start writing.*
Once the learner has completed their name show them the picture of the "car" and say, **Kuyini lokhu? Yebo, "imoto". Bhala igama elithi "imoto" lapha** *(indicate on the piece of paper where the learners should write "imoto"). Cover this part of the page when the learner is writing.*

SCORING – name writing			
76. name spelled correctly		77. surname spelled correctly	

SCORING – imoto	
78. correct:	
79. _i	
80. im	
81. mo	
82. ot	
83. to	
84. o_	

igama


[i] RAN objects and RAN letters tasks used with permission from Second Early Grade Reading Study Grade 2 Learner Assessment (USAID/Department of Basic Education, 2018)

[ii] ORF test used with permission from ERA. The ERA Xhosa literacy tests were adapted and modified from the original Xhosa EGRA tests received from the EC provincial department of Basic Education. Funded by Zenex, Dr Lauren Wildschut from ERA and Prof EJ Pretorius from Unisa adapted, piloted and revised the original EGRA assessments during 2015-2016.

9.3.1.3 A2.1.2: English

Standardised tests not reproduced.

Grade 1 English

Literacy: ORF – Jabu and his dog[i]

English
Instructions for learner:
Place chart in front of the learner **I am going to ask you to read a story to me out loud. This is a story written in English so I will ask you to read it in English to me. Read as best you can. I will ask you some questions when you are finished reading so make sure to remember what you read. I will tell you when to stop reading.** **This story is called "Jabu and his dog"** **Are you ready to read the story to me out loud?** **Start.** *(Start from first word of story, not title)* *Start timer when you say start.* *Capture the last word attempted at the 1-minute mark.* ***Discontinue if child cannot read first five words.***

Jabu and his dog	
Jabu had a little dog. It was a happy dog.	10
Jabu liked his dog.	14
One day Jabu and his dog walked in the bush behind the house.	27
The dog saw a rabbit and chased it.	35
The dog got lost.	39
Jabu called him but he didn't come.	46
Jabu was sad. He went home.	52
But before evening the little dog came back.	60
Jabu was very happy. He gave his dog a bone.	70

SCORING – oral reading fluency			
1. **Task discontinued**		2. **Number of errors**	
3. **Number of words attempted**		4. **Time remaining**	

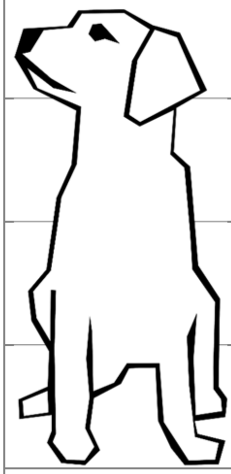
Literacy: ORF – Spelling

Once the learner has completed their name show them the picture of the "car" and say, **Yintoni le? Ewe, yi-"inja". Bhala phantsi igama "inja" apha.** *(indicate on the piece of paper where the learners should write "imoto"). Cover this part of the page when the learner is writing.*

SCORING – imoto	
5. **correct:**	
6. **_d**	
7. **do**	
8. **og**	
9. **g_**	

1

Grade 1 English



[i] Grade 2 EGRS II Wave 3 2018 Assessment Task used with permission from the Department of Basic Education.

9.3.2 A3.2: Start of grade 3 (t2) research instruments

9.3.2.1 A3.2.1: isiXhosa

Grade 3 isiXhosa

PHONOLOGICAL PROCESSING AND LITERACY – ISIXHOSA Grade 3

Learner Unique ID:

Date of test: 2021/ /

Learner Name and Surname:

Learner is a

School:

Test development: MN Schaefer and AC Wilsenach (with permission to use tests from other projects)

Translation: Mlami Diko and Siphuxolo Bikwe

Recommended Citation:

Schaefer, M. (2021, July 27). Phonological processing skills and their longitudinal relation to first and additional language literacy in isiXhosa and isiZulu speaking children. https://doi.org/10.17605/OSF.IO/GMNWS

Data capture completed / / **by**

Comments:

Scoring:

Correct = 1

Incorrect = 0

Nonresponse = NA

1

Verbal Assent: Siza kudlala imidlalo yezandi. Ndiza kukuxelela indlela yokudlala ngayo. Ngaba oku kulungile?

PA: Blending Time start:

Materials: audio files, headphones
Ceiling: none. Child must complete all items.
Note: the items can be repeated once only if the child asks you to
Prompt: if the child says the sounds separately (e.g. i-nj-a) and copies exactly what s/he heard, prompt by saying, ***Try to say the sounds all together as a real word*. Zama ukuthetha izandi zonke kunye njengegama eli yinyani.** This prompt can be used as many times as needed for the examples, and once for each item.
Feedback: corrective feedback given for the example items only. Run through the examples until the child understands how the activity works. Do the second example as needed.

	Syllable Blending	
	Kulo mdlalo uza kuva iindawana ezithile zamagama, uza kuva isuntswana libe linye ngexesha. Ndifuna uphulaphulisise uze emveni koko udibanise loo masuntswana enze igama elipheleleyo. Sowulungile? Masizame elinye.	
	Ezi zandi zenza ntoni? Feedback: examples Correct: **Yiyo leyo. Masizame elandelayo.** Incorrect: **Asiyiyo ncam leyo. Xa ubeka u-X kunye no-X zenza u-XX. Yizame, X-X zenza u___?**	
E1	u – bi – si	
E2	hla – la	
Instruction: Ezi zandi zenza eliphi igama ?		SCORE
1.	khu – le – la	
2.	i – bha – na – na	
3.	i – si – fu – ba	
4.	nya – ma – la – la	
	Phoneme Blending	
	Kulungile. Mamelisisa ke ngoku. Uza kuva amanye amagama anamasuntwana ancitshiswe nangakumbi, isuntswana ngalinye ngexesha. Ndifuna umamelisise ube sele udibanisa la masuntswana enze igama elipheleleyo. Sowulungile? Masizame ibe nye.	
	Ezi zandi zenza eliphi igama? Feedback: examples Correct: **Yiyo leyo. Masizame elandelayo.** Incorrect: **Asiyiyo ncam leyo. Xa ubeka u-X kunye no-X zenza u-XX. Yizame, X-X zenza u______?**	
E3	z – a	
E4	o – m – a	
Ezi zandi zenza ntoni?		SCORE
5.	f – a	
6.	o – s – a	
7.	s – i – k – a	
8.	x – o – l – a	
9.	i – j – e – z – i	
10.	i – nk – a – w – u	

PA - Elision

Materials: none
Ceiling: none. Child must complete all items.
Note: prompt can be repeated once only per item
Feedback: corrective feedback given for the example items only. Run through the examples until the child understands how the activity works. Do the second example as needed.

	Syllable Elision			
	Masidlale umdlalo wegama. Yithi "......". Yithi ke ngoku "........" ungambizanga u- ".......". e.g. Yithi "vuya" Yithi ke ngoku "vuya" ungambizanga u- "vu".			
	Feedback: examples Correct: Yiyo leyo. Masizame elandelayo. Incorrect: Asiyiyo ncam leyo. U-vuya ungambizanga u-vu ngu-ya.			
	Yithi	*ungambizanga u*	*Answer*	
E5	vuya	vu	ya	
E6	sebenza	nza	sebe	
	Yithi	*ungambizanga u-*	*Answer*	SCORE
11.	baleka	ba	leka	
12.	sondela	so	ndela	
13.	isifo	fo	isi	
14.	indaba	ba	inda	
15.	intamo	nta	imo	
16.	phawula	wu	phala	
	Phoneme Elision			
	Kulungile. Ngoku ke masizame amanye apho sisusa amasuntswana athile amagama. Yithi "......". Yithi ke ngoku "........"ungambizanga u ".......". Ngoku sizakususa iindawana ezizi ncinci ekuqaleni kwegama, uze undixelele okuseleyo egameni elo. e.g. Yithi "iculo" Yithi ke ngoku "iculo" ungamibanga u- "i".			
	Feedback: examples Correct: Kulungile. Ake sizame elilandelayo. Incorrect: Lokhu akulona iqiniso. U-*iculo* ngaphandle kuka-*"i"* ungu-*"culo"*.			
	Yithi	ungambizanga u	*Answer*	
E7	iculo	i	culo	
E8	nika	n	ika	
	Yithi	ungambizanga u	*Answer*	SCORE
17.	ikati	i	kati	
18.	bona	b	ona	
19.	mela	m	ela	
20.	linga	l	inga	

PA - Isolation

Materials: none
Ceiling: none. Child must complete all items.
Note: prompt can be repeated once only per item
Feedback: corrective feedback given for the example items only. Run through the examples until the child understands how the activity works. Do the second example as needed.

	Phoneme Isolation		
	Ngoku siza kudlala umdlalo wamagama apho ndiza kukucela ubize amasuntswana athile amagama. Siza kusebenzisa ezi ziciko zebhotile ukuze zisincedise.		
	Feedback: examples Correct: Yiyo leyo. Isandi sokuqala ku"na" ngu-/n/. Incorrect: Asiyiyo ncam. Isandi sokuqala ku-"na" ngu-/n/. No response: Isandi sokuqala ku-"na" ngu-/n/.		
E9	Igama elithi "na" linezandi ezimbini. / n / / a /. sesiphi isandi sokuqala sokuthi "na"?	/n/	
E10	Igama elithi "indlu" linezandi ezintathu / i / / ndl / / u /. Sesiphii isandi sokugqibela – sokuthi "indlu"	/u/	
	Instructions	*Answer*	SCORE
21.	Igama elithi "ma" linezandi ezimbini. / m / / a /. Sesiphi isandi sokuqala sokuthi "ma"?	/m/	
22.	Igama elithi "ona" linezandi ezintathu / o / / n / / a /. Sesiphi isandi sokugqibela sokuthi "ona"	*/a/*	
23.	Igama elithi "inja" linezandi ezintathu. / i / / nj / / a /. Sesiphi isandi esiphakathi sokuthi "inja"?	*/nj/*	
24.	Igama elithi "ipali" linezandi ezintlanu kulo. / i / / p / / a / / l / / i /. Sesiphi isandi sesibini sokuthi "ipali"?	*/p/*	
25.	Igama elithi "vuka" linezandi ezine kulo. / v / / u / / k / / a /. Sesiphi isandi sesibini sokuthi "vuka"?	*/u/*	

Comments:

Verbal Assent: Siza kumamela izandi ezithile size siziphinde. Ingaba kulungile oko?

PWM - Digit Span   Time start:

Materials: computer to play recorded digit span items
Ceiling: **stop** after child gets **3 items incorrect consecutively**
Feedback: feedback given only for examples. Do both examples.
Scoring: score 1 point for each test trial completed without error (all numbers must be said in the correct order).
Note: if child asks to have an item repeated say, **Ndiyakwazi ukudlala izandi ezirekhodiweyo kanye kuphela.**

Instructions for learner		
Ask the child to count to 6 in their L1. If they cannot count to six, then do not administer the task. Uyacelwa ukuba ubale ukusuka kwisinye ukuya kwisithandathu ngesiXhosa.		
26. *Can child count to 6 in L1? (circle appropriate answer)*	*Yes = continue*	*No = stop*
Ndiza kukucela ukuba unxibe ezi hedifoni ukuze umamele uqophelo olusekhompyutheni yam. Uza kuva amanani athile, elinye emveni kwelinye. Emveni kokuba uve amanani, ndifuna uwabize ngokulandelelana kwawo ngalaa ndlela uweve ebizwa ngayo. Mamelisisa kuba andizokuwaphinda amanani. Masizame amanye okuziqhelanisa. *Play the audio files, pausing after each trial to allow the child to respond. Provide feedback for examples only.*		

Item	Digits	SCORE
E11	5 2	
E12	5 1 4	
27.	6 1	
28.	2 5	
29.	1 4	
30.	5 3 1	
31.	6 2 4	
32.	4 1 6	

Item	Digits	SCORE
33.	5 3 1 4	
34.	3 5 2 6	
35.	2 5 1 6	
36.	4 1 6 3 5	
37.	6 3 2 5 1	
38.	5 2 4 6 3	
39.	3 1 4 6 5 2	
40.	4 6 1 3 5 2	
41.	4 3 6 2 5 1	

PWM – Non word Repetition

Materials: computer to play recorded nonword items
Ceiling: **stop** after child gets **3 items incorrect consecutively**
Feedback: feedback given only for examples
Scoring: score 1 point for each test trial completed without error (all nonwords must be said exactly the same as the prompt).
Note: if child asks to have an item repeated say, **Ndiyakwazi ukudlala izandi ezirekhodiweyo kanye kuphela.**

Instructions for learner
Ndifuna umamele amanye amagama enziweyo, emveni kokuba uve igama ngalinye elenziweyo ndifuna ulibize ngqo ngale ndlela ulive ngayo ngokuc acileyo . **Nokuba kunzima ukulibiza , zama kangangoko unako. Mamelisisa kuba andizokuwaphinda amagama. Masizame amanye.** *Play the CD, pausing after each trial to allow the child to respond. Provide feedback for examples only* *If correct:* **Ewe, ilungile.** *If incorrect:* **Asiyiyo ncam. Igama ibingu-__________. Masizame elinye.**

	Nonword	Score
E15	cikofe	
E16	pelazane	
42.	yemodo	
43.	baluki	
44.	fitshuli	
45.	lutsibadu	
46.	hlivejuno	
47.	gomvenizi	
48.	zatilayishi	
49.	bontukazeva	

	Nonword	Score
50.	dlimadwifi	
51.	mogosidoletha	
52.	wintenalwagiye	
53.	zutugoxongcida	
54.	nayulongwakhubazi	
55.	shwenzifesangenoda	
56.	modwitshaqokhemasho	
57.	niconzomethazumbosha	
58.	hlevashaniqobutenti	
59.	kolohlawezatasafi	

Verbal Assent: Siza kudlala umdlalo apho kufuneka ubize amagama ezinto/imibala/oonobumba/amanani ukhawulezisa kangangoko unako. Ingaba kulungile?

RAN - objects[i]	Time start:

Materials: object naming chart, stopwatch
Ceiling: discontinue only if child is unable to do the task
Scoring: the score for this subtest is the number of seconds that it takes the examinee to name all of the objects on the form. Items are marked incorrect if the child skips the object or gives it the wrong name. If the child skips a line, score the first object on the skipped line as incorrect and try to redirect the child to the correct line. If the child hesitates for more than 2 seconds on an object, mark it as incorrect and point to the next item and say, **Qhubeka**.

Instructions for learner:
Show practice page (chart 1.1.) and say, **Ziintoni ozibona kweli phepha?** *(point to first object and continue pointing if necessary. If the child makes any errors, correct the child, and have him/her repeat all the objects again. inkwenkwezi, isandla, itafile, inja, incwadi, ilanga)* *Say,* **Uza kubiza amagama ezinto ozibonayo ukhawulezisa kangangoko unako.** *Show the next page (chart 1.2.) and say,* **Masiyizame. Xa ndisithi qalisa, uza kuqala apha, ubize amagama ezinto ezi kule rowu ngaphambi ngokuba udlulele kwelandelayo. Biza igama le nto ekwirowu nganye ukhawulezisa kangangoko unako de uyofika ekugqibeleni. Zama ukuba ungatsibi nanye into. Uyaqonda?** *Put a blank sheet on top of the form to cover the objects for about 5 seconds. Say,* **Uza kuqalisa xa ndityhila iphepha. Sowulungile? Qalisa.** *Quickly take cover off the page, and start timing as soon as the child says the first object's name. Stop timing when the name of the last object is pronounced. Keep track of errors by putting a slash through each wrong item. When the child is finished, record time and errors.*

SCORING – RAN objects			
60. **number of errors**		61. **total time taken**	

RAN - letters[i]

Materials: letter naming chart, stopwatch
Ceiling: discontinue only if child is unable to do the task
Scoring: the score for this subtest is the number of seconds that it takes the examinee to say the sounds of the letters on the form. Items are marked incorrect if the child skips the letter or gives it the wrong sound. If the child skips a line, score the first letter on the skipped line as incorrect and try to redirect the child to the correct line. If the child hesitates for more than 2 seconds on a letter, mark it as incorrect and point to the next item and say, **Qhubeka.**

Instructions for learner
Show practice page (chart 2.1.) and say, **Ngabaphi oonobumba obabonayo kweli phepha? Sesiphi isandi esenziwa ngunobumba ngamnye?** *(point to first colour and continue pointing if necessary. If the child makes any errors, correct the child, and have him repeat all the colours again.) Say,* **Uza kube ubiza izandi zabanye oonobumba ukhawulezisa kangangoko unako.** *Show the next page (chart 2.2.) and say*, **Masiyizame. Xa ndisithi qalisa, uza kuqalisa apha ubize izandi zaba nobumba bakule rowu ngaphambi kokuba udlulele kwirowu elandelayo. Vele ubize izandi zoonobumba kwirowu nganye ukhawulezisa kangangoko unako de uyofika ekugqibeleni. Zama ukuba ungatsibi nomnye unobumba. Uyaqonda?** *Put a blank sheet on top of the form to cover the letters for about 5 seconds. Say,* **Uza kuqalisa xa ndityhila iphepha. Sowulungile? Qalisa.** *Quickly take cover off the page, and start timing as soon as the child says the first letter's sound. Stop timing when the name of the last number is pronounced. Keep track of errors by putting a slash through each wrong item. When the child is finished, record time and errors.*

Chart 2.2.

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

SCORING – RAN letters			
62. Discontinued at practice: Child does not know letters			
63. number of errors		64. total time taken	

Verbal Assent: Ndiza kukucela ukuba ufunde ke ngoku. Ingaba kulungile?

Literacy: letter sound recognition Time start:  60s

Instructions for learner
Place chart 3 in front of the learner **Ndiza kukucela ukuba undifundele abanye boonobumba besiXhosa. Ndicela undixelele ukuba unobumba ngamnye umele esiphi isandi. Ndicela ufunde oonobumba abaninzi kangangoko unako ukusuka ekhohlo ukuya ngasekunene ngokwalo mzekelo** (show example)**. Ndiza kukuxelela ukuba yima nini.** **Sowulungile?** **Qalisa.** *Start timer (one minute) when you say start.* • ***Circle*** *the* ***last*** *letter read when the time ran out.* • *Place a* ***diagonal*** *line through the letters which are read* ***incorrectly****.* • ***CEILING:*** *Stop the task if the child makes* ***5 consecutive errors***

Chart 3

m	l	h	g	S	y	Z	W	p	n	10
L	th	T	c	B	a	hl	o	n	ng	20
i	b	th	M	U	sh	j	dl	K	u	30
g	R	B	kh	L	f	hl	M	s	kw	40
S	N	ph	B	P	v	k	a	E	D	50
R	A	t	P	F	sh	h	u	a	t	60
dw	G	H	B	S	l	g	m	i	j	70
B	dl	o	m	O	Y	E	N	p	t	80
g	K	B	ny	Y	bh	Z	V	D	nc	90
f	s	ng	a	Z	p	C	th	G	sw	100
V	ncw	q	h	ntl	g	sh	y	kh	t	110

SCORING – letter sound recognition			
65. **Task discontinued**		66. **Number of errors**	
67. **Number of letters attempted**		68. **Time remaining**	

Literacy: word reading fluency

Instructions for learner
Place chart 4 in front of learner. **Ndicela ufunde la magama ngokuvakalayo. Ndiza kukuxelela ukuba yima nini. Sowulungile? Qalisa.** • Record the total time taken to complete the task. Start the timer when you say start. • Indicate errors by placing a diagonal line through the word. • ***CEILING:*** *Stop the task if the child makes* ***5 consecutive errors and circle last item read.***

Chart 4

ya	abo	into	lala	beka
igama	amanzi	imoto	phuma	funa
vula	mela	usana	unyawo	wela
thwala	uthuli	intombazana	ufudo	usiba

SCORING – word reading fluency			
69. **Task discontinued**			
70. **number of errors**		71. **total time taken**	

Literacy: oral reading fluency[ii]

60s

Instructions for learner:
Place chart 5 in front of the learner **Ndiza kukucela ukuba undifundele ibali ngokuvakalayo. Fundisisa kangangoko unako.** **Eli bali libizwa ngokuba ngu-"Jabu nenja yakhe"** **Sowukulungele ukufunda ibali ngokuvakalayo? Ndiza kukuxelela ukuba yeka nini ukufunda.** **Qalisa.** *Start timer when you say start. Record the incorrectly read words by placing a diagonal line through them. Circle the last word attempted when the time ran out.* ***Discontinue if child cannot read first five words.***

Chart 5

Isuphu Yelitye	words
Kwakukho umhambi owayelambe kunene.	4
Wahamba engena ecela amalizo.	8
Kwakungekho kutya, kwanto tu kwaphela emizini.	14
Umhambi wachola imbiza.	17
Wachola namatye agudileyo wawafaka embizeni.	22
Wagalela amanzi wabasa umlilo wapheka.	27
Wachopha walinda de yabila imbiza.	32
Kwafika umfazana wafuna ukwazi okuphekwa ngumhambi.	38
"Ndipheka isuphu yelitye emnandi. Ukuba ndingathi chatha nto ukuyinika isongo?" waphendula umhambi.	50
"Ndinayo iminqathe," wabe selenika umhambi umfazana.	56

SCORING – oral reading fluency			
72. **Task discontinued**		73. **Number of errors**	
74. **Number of words attempted**		75. **Time remaining**	

Literacy: early writing and spelling

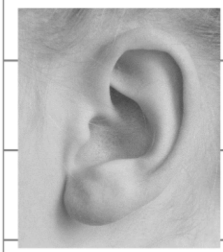
Instructions for learner.
Show the learner the picture of the “car” and say, **Yintoni le? Ewe, yi-“moto”. Bhala phantsi igama “imoto” apha.** *(indicate on the piece of paper where the learners should write “imoto”). Cover this part of the page when the learner is writing.*

SCORING – imoto	
76. **correct:**	
77. **_i**	
78. **im**	
79. **mo**	
80. **ot**	
81. **to**	
82. **o_**	

Show the learner the picture of the “car” and say, **Yintoni le? Ewe, yi-“ndlebe”. Bhala phantsi igama “indlebe” apha.** *(indicate on the piece of paper where the learners should write “indlebe”). Cover this part of the page when the learner is writing.*

SCORING – indlebe	
83. **correct:**	
84. **_i**	
85. **in**	
86. **nd**	
87. **dl**	
88. **le**	
89. **eb**	
90. **be**	
91. **e_**	

Grade 3 isiXhosa



[i] RAN objects and RAN letters tasks used with permission from Second Early Grade Reading Study Grade 2 Learner Assessment (USAID/Department of Basic Education, 2018)

[ii] ORF test used with permission from ERA. The ERA Xhosa literacy tests were adapted and modified from the original Xhosa EGRA tests received from the EC provincial department of Basic Education. Funded by Zenex, Dr Lauren Wildschut from ERA and Prof EJ Pretorius from Unisa adapted, piloted and revised the original EGRA assessments during 2015-2016.

9.3.2.2 A3.2.2: isiZulu

PHONOLOGICAL PROCESSING AND LITERACY – ISIZULU Grade 3

Learner Unique ID:

Date of test: 2021/ /

Learner Name and Surname:

Learner is a

School:

Test development: MN Schaefer and AC Wilsenach (with permission to use tests from other projects)
Translation: Celani Zwane and Nthabiseng Tsotetsi

Recommended Citation:
Schaefer, M. (2021, July 27). Phonological processing skills and their longitudinal relation to first and additional language literacy in isiXhosa and isiZulu speaking children. https://doi.org/10.17605/OSF.IO/GMNWS

Data capture completed 2021/ / **by**

Comments:

Scoring:
Correct = 1
Incorrect = 0
Nonresponse = NA

Verbal Assent: Sizobe sidlale imidlalo emisindo manje. Ngizokutshela ukuthi ungadlala kanjani. Ingabe lokhu kulungile?

PA: Blending Time start:

Materials: audio files, headphones
Ceiling: none. Child must complete all items.
Note: the items can be repeated once only if the child asks you to
Prompt: if the child says the sounds separately (e.g. i-nj-a) and copies exactly what s/he heard, prompt by saying, ***Try to say the sounds all together as a real word.*** **Zama ukusho imisindo yonke njengezwi langempela.** This prompt can be used as many times as needed for the examples, and once for each item.
Feedback: corrective feedback given for the example items only. Run through the examples until the child understands how the activity works. Do the second example as needed.

	Syllable Blending	
	Kulo mdlalo, ngizobiza igama ngezinxenye ezihlukene, ezincane, ingxenye eyodwa ngesikhathi. Ngifuna ulalele ngokucophelela bese uhlanganisa lezi zingxenye ndawonye ukuze wenze igama eliphelele. Ukulungele? Ake sizame elilodwa.	
	Yiliphi igama elenziwa ile misindo? Feedback: examples Correct: Ake sizame okulandelayo. Incorrect: Lokhu akulona iqiniso. Uma ufaka u-x no-x ndawonye kwenza u-xx. Zama u-x-x kwenza _____? Ake sizame okulandelayo.	
E1	u – bi - si	
E2	hla – la	
Instruction: Yiliphi igama elenziwa ile misindo?		SCORE
1.	khu – le – la	
2.	u – bha – na – na	
3.	i – si – fu – ba	
4.	nya – ma – la – la	
	Phoneme Blending	
	Kulungile. Lalela ngokucophelela manje. Manje ngizophimisa izinxenye ezihlukene ezenza igama elilodwa, ingxenye eyodwa ngesikhathi. Ngifuna ulalele ngokucophelela bese ubeka lezi zingxenye ndawonye/uhlanganisa lezi zinxenye ukuze wenze igama eliphelele. Ukulungele? Ake sizame elilodwa.	
	Yiliphi igama elenziwa ile misindo? Feedback: examples Correct: Ake sizame okulandelayo. Incorrect: Lokhu akulona iqiniso. Uma ufaka u-x no-x ndawonye kwenza u-xx. Zama u-x-x kwenza _____? Ake sizame okulandelayo.	
E3	z – a	
E4	o – m – a	
Yiliphi igama elenziwa ile misindo?		SCORE
5.	f – a	
6.	o – s – a	
7.	s – i – k – a	
8.	x – o – l – a	
9.	i – j – e – z – i	
10.	i – nk – a – w – u	

PA - Elision

Materials: none
Ceiling: none. Child must complete all items.
Note: prompt can be repeated once only per item
Feedback: corrective feedback given for the example items only. Run through the examples until the child understands how the activity works. Do the second example as needed.

	Syllable Elision			
	Masidlale umdlalo wegama. Yisho "….." Manje yithi "……"ungambizanga u-"….". Sizoqala ngokusho igama eliphelele bese silandela ngokulisho sikhiphe ingxenye ethile yalo, yithi "vuya", uma ususa "vu" yisho ukuthi kusala ubani? e.g. Yisho "vuya" Manje yithi "vuya" ungambizanga u-"ya".			
	Feedback: examples Correct: Kulungile. Ake sizame elilandelayo. Incorrect: Lokhu akulona iqiniso. U-*vuya* ungambizanga u-*vu* ungu-*ya*.			
	Yithi	ungambizanga u-	*Answer*	
E5	vuya	vu	ya	
E6	sebenza	nza	sebe	
	Yithi	*ungambizanga u-*	*Answer*	SCORE
11.	baleka	ba	leka	
12.	sondela	so	ndela	
13.	isifo	fo	isi	
14.	indaba	ba	inda	
15.	intamo	nta	imo	
16.	phawula	wu	phala	
	Phoneme Elision			
	Kulungile. Manje ake sizame lapho sithatha khona izingxenye ezincane zamagama. Yisho "…..". Manje yithi "……."ungambizanga u "…". Manje sizosusa ingxenye encane ekuqaleni kwegama bese wena usho ukuthi ithini ingxenye yegama esele egameni. e.g. Yisho "iculo". Yithi "iculo" ungambizanga u -"i".			
	Feedback: examples Correct: Kulungile. Ake sizame elilandelayo. Incorrect: Lokhu akulona iqiniso. U-*iculo* ngaphandle kuka-*"i"* ungu-*"culo"*.			
	Yithi	ungambizanga u	*Answer*	
E7	iculo	i	culo	
E8	nika	n	ika	
	Yithi	ungambizanga u	*Answer*	SCORE
17.	ikati	i	kati	
18.	bona	b	ona	
19.	mela	m	ela	
20.	linga	l	inga	

PA - Isolation

Materials: none
Ceiling: none. Child must complete all items.
Note: prompt can be repeated once only per item
Feedback: corrective feedback given for the example items only. Run through the examples until the child understands how the activity works. Do the second example as needed.

	Phoneme Isolation		
	Manje sizokwenza umdlalo wegama lapho ngizokucela ukuba usho izingxenye zamagama. Ngizobiza imisindo yegama elilodwa bese ngikubuza imibuzo ngaleyo misindo.		
	Feedback: examples Correct: Kulungile. Umsindo wokuqala “na” u- /n/. Incorrect: Lokhu akulona iqiniso. Umsindo wokuqala “na” u- /n/. No response: Umsindo wokuqala “na” u/n/.		
E9	Igama elithi "na" linemisindo emibili . / n / / a /. yimuphi/uthini umusindo wokuqala egameni elithi “na”?	/n/	
E10	Igama elithi "indlu linemisindo emithathu / i / / ndl / / u /. yimuphi/uthini umsindo osekugcineni egameni elithi “indlu”? -	/u/	
	Instructions	*Answer*	SCORE
21.	Igama elithi "ma" linemisindo emibili. / m / / a /. yimuphi/uthini umsindo wokuqala egameni elithi “ma”?	/m/	
22.	Igama elithi "ona" linemisindo emithathu / o / / n / / a /. –yimuphi/uthini umsindo wokugcina egameni elithi “ona”?	*/a/*	
23.	Igama “inja” linemisindo emithathu. /i/ /nj/ /a/. yimuphi/uthini umsindo ophakathi egameni elithi "inja"?	*/nj/*	
24.	Igama elithi "ipali" linemisindo emihlanu kulo. / i / / p / / a / / l / / i /. yimuphi/uthini umsindo wesibili egameni elithi "ipali"?	*/p/*	
25.	Igama elithi "vuka" linemisindo emine kulo. / v / / u / / k / / a /. yimuphi/uthini umsindo wesibili egameni elithi "vuka"?	*/u/*	

Comments:

Verbal Assent: Sizolalela imisindo ethile bese siyiphinda. Ingabe lokhu kulungile?

PWM - Digit Span Time start:

Materials: computer to play recorded digit span items
Ceiling: **stop** after child gets **3 items incorrect consecutively**
Feedback: feedback given only for examples. Do both examples.
Scoring: score 1 point for each test trial completed without error (all numbers must be said in the correct order).
Note: if child asks to have an item repeated say, **Ngingadlala kuphela imisindo eqoshiwe kanye.**

Instructions for learner		
Ask the child to count to 6 in their L1. If they cannot count to six, then do not administer the task. **Kulomdlalo ngizocela ubale kusuka kokunye kuze kufike kokuyisithupha.**		
26. Can child count to 6 in L1? (circle appropriate answer)	*Yes = continue*	*No = stop*
Manje ngizokucela ukuthi ugqoke okokulalela ezindlebeni ukuze ulalele lokhu okurikhodwe kwikhompyutha yami. Uzozwa izinombolo ezithile, ngokulandelana. Emva kokuzwa izinombolo, ngifuna ukuthi uzisho ngendlela ezilandelana ngayo. Lalela ngokucophelela ngoba angikwazi ukuphinda izinombolo. Ake sizame izibonelo ukuze siziqeqeshe. *Play the CD, pausing after each trial to allow the child to respond. Provide feedback for examples only.*		

Item	Digits	SCORE
E11	5 2	
E12	5 1 4	
27.	6 1	
28.	2 5	
29.	1 4	
30.	5 3 1	
31.	6 2 4	
32.	4 1 6	

Item	Digits	SCORE
33.	5 3 1 4	
34.	3 5 2 6	
35.	2 5 1 6	
36.	4 1 6 3 5	
37.	6 3 2 5 1	
38.	5 2 4 6 3	
39.	3 1 4 6 5 2	
40.	4 6 1 3 5 2	
41.	4 3 6 2 5 1	

PWM – Non word Repetition

Materials: computer to play recorded nonword items
Ceiling: **stop** after child gets **3 items incorrect consecutively**
Feedback: feedback given only for examples
Scoring: score 1 point for each test trial completed without error (all nonwords must be said in the correct order).
Note: if child asks to have an item repeated say, **Ngingadlala kuphela imisindo eqoshiwe kanye.**

Instructions for learner
Ngifuna ukuthi ulalele lamagama akhiwe; emva kokuthi uzwe ngalinye igama elakhiwe ngifuna ukuthi usho kahle njengoba uzwile futhi ngokucacile ngendlela ongakwazi ukusho ngayo. Ngisho noma kunzima ukusho, zinike ithuba elenele lokuzama. Lalela ngokucophelela ngoba angikwazi ukuphinda amagama. Kulungile? Ake sizame lawa alandelayo. *Play the CD, pausing after each trial to allow the child to respond. Provide feedback for examples only.* *Feedback* *If correct:* **Yebo, kunjalo.** *If incorrect:* **lokho akulona iqiniso. Igama olizwile lithi ________. Ake sizame elinye.**

	Nonword	Score
E15	cikofe	
E16	pelazane	
42.	yemodo	
43.	fitshuli	
44.	baluki	
45.	lutsibadu	
46.	hlivejuno	
47.	gomvenizi	
48.	zatilayishi	
49.	bontukazeva	

	Nonword	Score
50.	dlimadwifi	
51.	mogosidoletha	
52.	wintenalwagiye	
53.	zutugoxongcida	
54.	nayulongwakhubazi	
55.	shwenzifesangenoda	
56.	modwitshaqokhemasho	
57.	niconzomethazumbosha	
58.	hlevashaniqobutenti	
59.	kolohlawezatasafi	

Verbal Assent: Sizobe sidlala umdlalo lapho kufanele usho amagama alezi zinto ezilandelayo / imibala / izinhlamvu / izinombolo ngokushesha ongakukhona. Ingabe lokhu kulungile?

RAN - objects[i] **Time start:**

Materials: object naming chart, stopwatch
Ceiling: discontinue only if child is unable to do the task
Scoring: the score for this subtest is the number of seconds that it takes the examinee to name all of the objects on the form. Items are marked incorrect if the child skips the object or gives it the wrong name. If the child skips a line, score the first object on the skipped line as incorrect and try to redirect the child to the correct line. If the child <u>hesitates for more than 2 seconds</u> on an object, mark it as incorrect and point to the next item and say, **Qhubeka**.

Instructions for learner:
Show practice page (chart 1.1.) and say, **Yiziphi izinto ozibonayo kuleli khasi** *(point to first object and continue pointing if necessary. If the child makes any errors, correct the child, and have him/her repeat all the objects again. Inkanyezi, isandla, itafula, inja, incwadi, ilanga) Say,* **Uzobe usho amagama alezi zinto ozibonayo ngendlela ongashesha ngayo.** *Show the next page (chart 1.2.) and say,* **Ake sizame. Uma ngikutshela ukuthi uqale, uzoqala lapha** *(point to upper left corner)* **bese ubiza le rowu** *(point to top row)* **ngaphambi kokuya erowini elandelayo** *(move your finger to the next row).* **Yisho nje izinto erowini ngayinye ngokushesha ongakwazi kuze kube sekugcineni. Zama ukungeqi noma iyiphi irowu. Uyaqonda?** *Put a blank sheet on top of the form to cover the objects for about 5 seconds. Say,* **Uzoqala ngokushesha nje lapho ngimbula leli khasi. Ukulungele? Qala.** *Quickly take cover off the page, and start timing as soon as the child says the first object's name. Stop timing when the name of the last object is pronounced. Keep track of errors by putting a slash through each wrong item. When the child is finished, record time and errors.*

SCORING – RAN objects			
60. **number of errors**		61. **total time taken**	

RAN - letters[i]

Materials: letter naming chart, stopwatch
Ceiling: discontinue only if child is unable to do the task
Scoring: the score for this subtest is the number of seconds that it takes the examinee to say the sounds of the letters on the form. Items are marked incorrect if the child skips the letter or gives it the wrong sound. If the child skips a line, score the first letter on the skipped line as incorrect and try to redirect the child to the correct line. If the child hesitates for more than 2 seconds on a letter, mark it as incorrect and point to the next item and say, **Qhubeka.**

Instructions for learner
Show practice page (chart 2.1.) and say, **Yiziphi izinhlamvu ozibonayo kuleli khasi? Yimuphi umsindo ngalinye eliwenzayo?** *(point to first colour and continue pointing if necessary. If the child makes any errors, correct the child, and have him repeat all the colours again.) Say,* **Uzobe ususho umsindo wezinye izinhlamvu ngokushesha ongakwazi.** *Show the next page (chart 2.2.) and say*, **Ake sizame. Uma ngikutshela ukuthi qala, uzoqala lapha** *(point to upper left corner)* **bese usho imisindo yalezi zinhlamvu kule rowu** *(point to top row)* **ngaphambi kokuya erowini elandelayo** *(move your finger to the next row).* **kumele usho umsindo wezinhlamvu erowini ngayinye ngokushesha ongakwazi uze ufike ekugcineni. Zama ukungatholi noma yiziphi izinhlamvu. Ingabe uyezwa?** *Put a blank sheet on top of the form to cover the letters for about 5 seconds. Say,* **Uzoqala ngokushesha nje lapho ngivula leli khasi. Ukulungele? Qala.** *Quickly take cover off the page, and start timing as soon as the child says the first letter's sound. Stop timing when the name of the last number is pronounced. Keep track of errors by putting a slash through each wrong item. When the child is finished, record time and errors.*

Chart 2.2.

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

SCORING – RAN letters			
62. **Discontinued at practice: Child does not know letters**			
63. **number of errors**		64. **total time taken**	

Verbal Assent: Ngizokucela ukuthi ufunde manje. Ingabe lokhu kulungile?

Literacy: letter sound recognition Time start:  60s

Instructions for learner
Place chart 3 in front of the learner **Ngizokucela ukuthi ungifundele izinhlamvu ezithile zesiZulu. Ngitshele ukuthi uhlamvu ngalunye lwenza muphi umsindo. Funda izinhlamvu eziningi ukusukela kwesokunxele kuya kwesokudla njengakulesi sibonelo** (show example). **Ngizokutshela ukuthi ume.** **Ingabe usulungile?** **Qala.** *Start timer (one minute) when you say start.* • ***Circle*** *the* ***last*** *letter read when the time ran out.* • *Place a* ***diagonal*** *line through the letters which are read* ***incorrectly****.* • ***CEILING:*** *Stop the task if the child makes* ***5 consecutive errors***

Chart 3

m	l	h	g	S	y	Z	W	p	n	10
L	th	T	c	b	a	hl	o	n	ng	20
i	b	th	M	U	sh	j	dl	K	u	30
g	R	B	kh	l	f	hl	M	s	kw	40
S	N	ph	B	p	v	k	a	E	D	50
R	A	t	P	f	sh	h	u	a	t	60
dw	G	H	B	S	l	g	m	i	j	70
B	dl	o	m	O	Y	E	N	p	t	80
g	K	B	ny	y	bh	Z	V	D	nc	90
f	s	ng	a	z	p	C	th	G	sw	100
V	ncw	q	h	nhl	g	sh	y	kh	t	110

SCORING – letter sound recognition			
65. **Task discontinued**		66. **Number of errors**	
67. **Number of letters attempted**		68. **Time remaining**	

Literacy: word reading fluency

Instructions for learner
Place chart 4 in front of learner. **Sicela ufunde la magama ngokuzwakalayo ngokusemandleni akho. Ngizokutshela ukuthi yima. Usukulungele? Qala.** • Record the total time taken to complete the task. Start the timer when you say start. • Indicate errors by placing a diagonal line through the word. • ***CEILING:*** *Stop the task if the child makes* ***5 consecutive errors and circle last item read.***

Chart 4

ya	abo	into	lala	beka
igama	amanzi	imoto	phuma	funa
vula	mela	usana	unyawo	wela
thwala	uthuli	intombazane	ufudu	usiba

SCORING – word reading fluency			
69. **Task discontinued**			
70. **number of errors**		71. **total time taken**	

Literacy: oral reading fluency[ii] 60s

Instructions for learner:
Place chart 5 in front of the learner **Ngizokucela ukuthi ungifundele indaba ngezwi eliphezulu. Funda ngokwekhono lakho.** **Le indaba ethi "UJabu nenja yakhe"** **Ingabe usukulungele ukungifundela indaba ngezwi eliphezulu? Ngizokutshela ukuthi ume.** **Qala.** *Start timer when you say start. Record the incorrectly read words by placing a diagonal line through them. Circle the last word attempted when the time ran out.* ***Discontinue if child cannot read first five words.***

Chart 5

Isobho lamatshe	words
Kunesihambi esasilambile kakhulu.	3
Sahamba sicela emizini yabantu. Abantu babengenakho ukudla. Isihambi sathola isu.	10
Isihambi sathola ibhodwe. Sathatha amatshe sawafaka ebhodweni.	20
Sathela amanzi. Sabasa umlilo, sabeka ibhodwe eziko.	27
Sama salinda ibhodwe laze labila.	32
Kwafika intombazane yacela ukwazi ukuthi siphekani isihambi eziko.	40
"Ngipheka isobho elimnandi lamatshe.	44
Kodwa kumele ngilifake into ukuze linongeke," kusho isihambi.	52
"Nginezaqathe mina," wabe esenika isihambi. Sazifaka ebhodweni.	59

SCORING – oral reading fluency			
72. **Task discontinued**		73. **Number of errors**	
74. **Number of words attempted**		75. **Time remaining**	

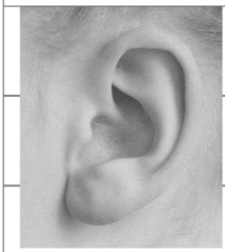
Literacy: early writing and spelling

Instructions for learner.
Show the learner the picture of the "car" and say, **Kuyini lokhu? Yebo, "imoto". Bhala igama elithi "imoto" lapha** *(indicate on the piece of paper where the learners should write "imoto"). Cover this part of the page when the learner is writing.*

SCORING – imoto	
76. **correct:**	
77. **_i**	
78. **im**	
79. **mo**	
80. **ot**	
81. **to**	
82. **o_**	

Show the learner the picture of the "ear" and say, **Kuyini lokhu? Yebo, "indlebe". Bhala igama elithi "indlebe" lapha** *(indicate on the piece of paper where the learners should write "indlebe"). Cover this part of the page when the learner is writing.*

SCORING – indlebe	
83. **correct:**	
84. **_i**	
85. **in**	
86. **nd**	
87. **dl**	
88. **le**	
89. **eb**	
90. **be**	
91. **e_**	



[i] RAN objects and RAN letters tasks used with permission from Second Early Grade Reading Study Grade 2 Learner Assessment (USAID/Department of Basic Education, 2018)

[ii] ORF test used with permission from ERA. The ERA Xhosa literacy tests were adapted and modified from the original Xhosa EGRA tests received from the EC provincial department of Basic Education. Funded by Zenex, Dr Lauren Wildschut from ERA and Prof EJ Pretorius from Unisa adapted, piloted and revised the original EGRA assessments during 2015-2016.

9.3.2.3 A3.2.3: English

Standardised tests not reproduced.

Grade 3 English

Literacy: ORF – Jabu and his dog

English
Instructions for learner:
Place chart in front of the learner **I am going to ask you to read a story to me out loud. This is a story written in English so I will ask you to read it in English to me. Read as best you can. I will ask you some questions when you are finished reading so make sure to remember what you read. I will tell you when to stop reading.** **This story is called "Jabu and his dog"** **Are you ready to read the story to me out loud?** **Start.** *(Start from first word of story, not title)* *Start timer when you say start.* *Capture the last word attempted at the 1-minute mark.* ***Discontinue if child cannot read first five words.***

Jabu and his dog	
Jabu had a little dog. It was a happy dog.	10
Jabu liked his dog.	14
One day Jabu and his dog walked in the bush behind the house.	27
The dog saw a rabbit and chased it.	35
The dog got lost.	39
Jabu called him but he didn't come.	46
Jabu was sad. He went home.	52
But before evening the little dog came back.	60
Jabu was very happy. He gave his dog a bone.	70

SCORING – oral reading fluency			
7. **Task discontinued**		8. **Number of errors**	
9. **Number of words attempted**		10. **Time remaining**	

Grade 3 English

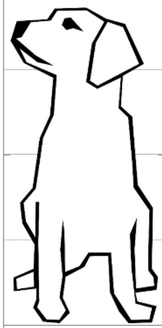
Literacy: Spelling

Point to the picture of the dog. In English, we call this "dog". Write "dog" here.

SCORING – dog [ii]	
11. **correct:**	
12. **_d**	
13. **do**	
14. **og**	
15. **g_**	

Point to the picture of the sheep. In English, we call this "sheep". Write "sheep" here.

SCORING – sheep	
16. **correct:**	
17. **_s**	
18. **sh**	
19. **he**	
20. **ee**	
21. **ep**	
22. **p_**	



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[i] Grade 2 EGRS II Wave 3 2018 Assessment Task used with permission from the Department of Basic Education.
[ii] Grade 1 EGRS II Wave 2 2017 Assessment Task "write dog"

9.3.3 A3.3: End of grade 3 (t3) research instruments

9.3.3.1 A3.3.1: isiXhosa and English: Individual Test

LITERACY – ISIXHOSA & ENGLISH
Grade 3 - end

Learner Unique ID:

Date of test: 2021/ /

Learner Name and Surname:

Learner is a

School:

Translation: Mlami Diko, Siphuxolo Bikwe, Ntombizethu Nyakambi

Recommended Citation:
Schaefer, M. (2021, July 27). Phonological processing skills and their longitudinal relation to first and additional language literacy in isiXhosa and isiZulu speaking children. https://doi.org/10.17605/OSF.IO/GMNWS

Data capture completed / / by

Comments:

Scoring:
Correct = 1
Incorrect = 0
Nonresponse = NA

Verbal Assent: Ndiza kukucela ukuba ufunde ke ngoku. Ingaba kulungile?

Literacy: letter sound recognition Time start: 60s

Instructions for learner
Place chart 3 in front of the learner
Ndiza kukucela ukuba undifundele abanye boonobumba besiXhosa. Ndicela undixelele ukuba unobumba ngamnye umele esiphi isandi. Ndicela ufunde oonobumba abaninzi kangangoko unako ukusuka ekhohlo ukuya ngasekunene ngokwalo mzekelo (show example). **Ndiza kukuxelela ukuba yima nini.**
Sowulungile?
Qalisa.
Start timer (one minute) when you say start.
• ***Circle** the **last** letter read when the time ran out.*
• *Place a **diagonal** line through the letters which are read **incorrectly**.*
• ***CEILING:** Stop the task if the child makes **5 consecutive errors***

Chart 3

m	l	h	G	S	y	Z	W	p	n	10
L	th	T	C	B	a	hl	o	n	ng	20
i	b	th	M	U	sh	j	dl	K	u	30
g	R	B	Kh	L	f	hl	M	s	kw	40
S	N	ph	B	P	v	k	a	E	D	50
R	A	t	P	F	sh	h	u	a	t	60
dw	G	H	B	S	l	g	m	i	j	70
B	dl	o	M	O	Y	E	N	p	t	80
g	K	B	Ny	Y	bh	Z	V	D	nc	90
f	s	ng	A	Z	p	C	th	G	sw	100
V	ncw	q	H	ntl	g	sh	y	kh	t	110

SCORING – letter sound recognition			
1. Task discontinued		2. Number of errors	
3. Number of letters attempted		4. Time remaining	

Literacy: word reading fluency

Instructions for learner
Place chart 4 in front of learner.
Ndicela ufunde la magama ngokuvakalayo. Ndiza kukuxelela ukuba yima nini. Sowulungile? Qalisa.
• Record the total time taken to complete the task. Start the timer when you say start.
• Indicate errors by placing a diagonal line through the word.
• ***CEILING:** Stop the task if the child makes **5 consecutive errors and circle last item read.***

Chart 4

ya	Abo	into	lala	beka

igama	Amanzi	imoto	phuma	funa
vula	Mela	usana	unyawo	wela
thwala	Uthuli	intombazana	ufudo	usiba

SCORING – word reading fluency			
5. **Task discontinued**		6. **Total attempted**	
7. **number of errors**		8. **total time taken**	

Literacy: oral reading fluency[i]

60s

Instructions for learner:
Place chart 5 in front of the learner **Ndiza kukucela ukuba undifundele ibali ngokuvakalayo. Fundisisa kangangoko unako.** **Eli bali libizwa ngokuba ngu-"Isuphu Yelitye".** **Sowukulungele ukufunda ibali ngokuvakalayo? Ndiza kukuxelela ukuba yeka nini ukufunda.** **Qalisa.** *Start timer when you say start. Record the incorrectly read words by placing a diagonal line through them. Circle the last word attempted after <u>1 minute</u>.* ***Discontinue if child cannot read first five words.*** *Allow two additional minutes for child to read up to question 5. Ask comprehension questions up to where the child read in three minutes.*

Isuphu Yelitye		words
Kwakukho umhambi owayelambe (Q1).	3	3
Wahamba engena ecela amalizo. Abantu babengena kutya (Q2). Umhambi wacinga icebo.	13	10
Umhambi wafumana imbiza. Wachola namatye agudileyo wawafaka embizeni (Q3).	21	8
Wagalela amanzi. wabasa umlilo, wabeka imbiza eziko (Q4).	28	7
Wachopha walinda imbiza ise ibile (Q5).	33	5
Kwafika intombazana icela ukwazi okwakuphekwa ngumhambi.	39	6
"Ndipheka isuphu yamatye emnandi.	43	4
Kodwa kusafuneka ndichathaze into ukuyinika isongo?" waphendula umhambi.	51	8
"Ndinayo iminqathe," wabe selenika umhambi. Wayifaka embizeni.	58	7

SCORING – oral reading fluency			
9. **Task discontinued**		10. **Number of errors**	
11. **Number of words attempted**		12. **Time remaining**	

Literacy: Reading comprehension[ii]

Umbuzo		Words read	Impendulo	Score
RC1.	1. Ngubani lo wayelambile? Who was hungry?	3	Ngumhambi. The visitor.	
RC2.	2. Yintoni abantu ababengenayo? What is it the people did not have?	11	Babengena kutya. They did not have food.	
RC3	3. Wenza ntoni umhambi ngamatya? What did the visitor do with the stones?	21	Wawafaka embizeni/ sawafaka. He/She put them in the pot and cooked them.	
RC4	4. Yintoni enye eyenziwa ngumhambi What else did the visitor do?	28	Wagalela amanzi embizeni/ wabasa umlilo/ wabeka imbiza eziko. He/She pour water in the pot/ set the fire/ put the pot on the fire.	
RC5	5. Wayemeleni umhambi kufutshane nembiza? Why was the visitor standing next to the pot?	33	Wayelinde imbiza ide ibile. He/she was waiting for water in the pot to boil.	

Literacy: Diagnostic Test of Word Reading Processes (English)

Participants completed the Diagnostic Test of Word Reading Processes: nonwords, regular words and sight words. The instructions in the test manual were followed for administration.

Literacy: ORF – How the elephant got its trunk[iii]

English
Instructions for learner:
Place chart in front of the learner **I am going to ask you to read a story to me out loud. This is a story written in English so I will ask you to read it in English to me. Read as best you can. I will ask you some questions when you are finished reading so make sure to remember what you read. I will tell you when to stop reading.** **This story is called "How the elephant got its trunk".** **Are you ready to read the story to me out loud?** **Start.** *(Start from first word of story, not title)* *Start timer when you say start. Record the incorrectly read words by placing a diagonal line through them. Circle the last word attempted after 1 minute.* ***Discontinue if child cannot read first five words.*** *Allow two additional minutes for child to read up to question 5. Ask comprehension questions up to where the child read in three minutes.*

How the elephant got its trunk

In times long ago, elephants had short noses [Q1].	***8***
One day Bubu [Q2], the baby elephant, went for a walk through the forest [Q3].	***21***
He always wanted to know things, so he asked lots of questions.	***33***
He walked to the bank of a river.	***41***
He had never seen a crocodile before.	***48***
"Hello, Mr Crocodile [Q4]. What do you like to eat?" Bubu asked politely.	***60***
The crocodile grabbed the little elephant by his nose and pulled hard [Q5].	***72***
But Bubu fought back by spreading out his legs and pulling back.	***84***
At each pull his nose grew longer and longer.	***93***
At last the crocodile let go of the nose and swam away.	***105***
Instead of his short nose, Bubu now had a long trunk.	***116***
He could do all kinds of new things with it!	***126***
[126 words]	

SCORING – oral reading fluency			
13. **Task discontinued**		14. **Number of errors**	
15. **Number of words attempted**		16. **Total time taken if completed before 1 min**	

Literacy: Reading Comprehension[iv]

Question		Word	Answer	Score
Erc1	Long ago, did elephants have long or short noses?	8	short noses	
Erc2	In this story, what is the name of the elephant?	11	Bubu	
Erc3	Where did Bubu, the elephant, go for a walk?	21	through the forest OR by the river (banks)	
Erc4	Who did Bubu talk to at the river?	51	He spoke to a/the/Mr crocodile.	
Erc5	Why did the crocodile grab Bubu's nose?	72	He wanted to eat him.	

[i] ORF test used with permission from ERA. The ERA Xhosa literacy tests were adapted and modified from the original Xhosa EGRA tests received from the EC provincial department of Basic Education. Funded by Zenex, Dr Lauren Wildschut from ERA and Prof EJ Pretorius from Unisa adapted, piloted and revised the original EGRA assessments during 2015-2016. The same text with changes to sentence one was used in the EGRS 2: Department of Basic Education, & University of the Witwatersrand. (2020). *Early Grade Reading Study 2019, Wave 4*. DataFirst. https://doi.org/10.25828/h109-3y92

[ii] Reading comprehension questions after ORF test from Second Early Grade Reading Study. Department of Basic Education, & University of the Witwatersrand. (2020). *Early Grade Reading Study 2019, Wave 4*. DataFirst. https://doi.org/10.25828/h109-3y92

[iii] ORF test from Second Early Grade Reading Study. Department of Basic Education, & University of the Witwatersrand. (2020). *Early Grade Reading Study 2019, Wave 4*. DataFirst. https://doi.org/10.25828/h109-3y92

[iv] Reading comprehension questions after ORF test from Second Early Grade Reading Study. Department of Basic Education, & University of the Witwatersrand. (2020). *Early Grade Reading Study 2019, Wave 4*. DataFirst. https://doi.org/10.25828/h109-3y92

9.3.3.2 A3.3.2: isiXhosa and English: Group Test

WRITTEN

LITERACY – ISIXHOSA & ENGLISH

Grade 3 - end

Learner Unique ID:

Date of test: 2021/ /

Learner Name and Surname:

School:

Data capture completed / / by

Scoring:
Correct = 1
Incorrect = 0
Nonresponse = NA

1

Upelo ngesiXhosa

Bhala la magama uwevayo ngesiXhosa ecaleni kwenani ngalinye.

1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	
10.	

3

Yima.

Sukutyhila iphepha ungekayalelwa ukuba wenze njalo.

isiXhosa - Imiyalelo

- Funda eli bali lingezantsi wandule ukuphendula imibuzo elandelayo.
- Unemizuzu elishumi elinesibini lokugqiba lo msebenzi.
- Phendula imibuzo kangangoko unako.
- Xa ugqibe kwangoko linda amanye amalungu eqela.
- Ndizakukuxelela xa kufuneka utyhile iphepha .

<u>Kutheni iMvubu ingenaboya?</u>

Ngenye imini umvundla wayezihambela ngasemlanjeni. UMvubu wayekhona naye, ezihambela ezityela nengca emnandi.

1. Babehamba phi uMvubu noMvundla?

---

2. Wayesitya ntoni uMvubu?

UMvubu akabonanga ukuba uMvundla nawo wayelapho, wamnyathela elunyaweni ngempazamo. UMvundla wathethela phezulu engxola ebhekise kuMvubu, "Mvubu, awuboni na ukuba uyandinyathela?" Waxolisa uMvubu wathi "Uxolo mhlobo wam, khange ndikubone. "Akafunanga nokuva uMvundla, waqhubeka engxolisa uMvubu wathi, "Wenze ngabom, ngenye imini ndizakubonisa! Uzobhatala!"

3. Wayemngxoliselani uMvundla uMvubu?

4

4. Ucinga ukuba yintoni eyenza ukuba uMvubu angamboni uMvundla?

____

____

UMvundla wahamba wayofuna uMlilo, wathi kuye "Hamba, uye kulinda uMvubu xa ephume emanzini eyokutya ingca, kulapho ke wena uzakufika umtshise khona. Undinyathele! "Waphendula uMlilo, "Akukho ngxaki mhlobo wam,ndizakwenza kanye ngokwesicelo sakho." Ngenye imini uMvubu wathi esazityela ingca kude nasemfuleni "whoosh!" uMlilo wajika wavutha amadangatye. Lo madangatye aqalisa ukutshisa uboya bukaMvubu. UMvubu wabaleka wayoziphosa emanzini. Uboya bakhe bonke babutshile ngumlilo. Wayekhala esithi "uboya bam butshiswe ngumlilo! Ubutshise bonke uboya bam! Uboya bam obuhle kangaka!" Yilonto uMvubu esoloko edlalela kufutshane namanzi kuba woyika ukuphinda atshiswe ngumlilo kwakhona. UMvundla wavuya kakhulu ngelixa ebona uMvubu etshiswa ngumlilo wathi, "Ndikufumene nam!"

5. Kwenzeka ntoni kuboya bukaMvubu?

____

6. Gqibezela esi sivakalisi silandelayo ngokukhetha impendulo echanileyo kwezi zilandelayo:

Ngokwalapha ebalini, ndicinga ukuba uMvundla wabonisa ________ kuMvubu.

(a) ubuntu
(b) akamfuni
(c) ukungabi naxolo
(d) uthando

Yima.

Sukutyhila iphepha ungekayalelwa ukuba wenze njalo.

Upelo ngesiNgesi

Bhala la magama owevayo ngesiNgesi ecaleni kwenani ngalinye.

1.
2.
3.
4.
5.
6.
7.
8.
9.
10.

7

Yima.

Sukutyhila iphepha ungekayalelwa ukuba wenze njalo.

English - Imiyalelo

- Funda ibali elingezantsi wandule ukuphendula imibuzo elandelayo.
- Unemizuzu esibhozo yokugqiba lo msebenzi.
- Phendula yonke imibuzo kangangoko unako.
- Ukuba ugqibe kuqala linda amanye amalungu eqela.
- Ndakukuxelela xa kufuneka utyhile iphepha.

<u>Jabu and his dog</u>

Jabu had a little dog. It was a fat and happy dog. One day Jabu and his dog went to play in the fields behind the house.

1. What is the name of the boy in the story? ______________________

2. Where did the boy and dog go and play one day?

____

The little dog saw a rabbit and tried to chase it. The dog got lost.

3. What happened to the dog?

Jabu called him but he didn't come. Jabu got tears in his eyes and went home. But before evening the little dog came back. Jabu was very happy to see his friend.

4. Why did the boy have tears in his eyes?

References

Original story

Why Hippos have no hair
Author - Basilio Gimo and David Ker
Illustration - Carol Liddiment
Language - English
Level - First paragraphs
© Little Zebra Books 2014
Creative Commons: Attribution 4.0
Source www.africanstorybook.org
Original source http://www.littlezebrabooks.com/.

Reading comprehension tests used in Second Early Grade Reading Study.

Department of Basic Education, & University of the Witwatersrand. (2020). Early Grade Reading Study 2019, Wave 4. DataFirst. https://doi.org/10.25828/h109-3y92

isiZulu spelling task adapted and translated from

Daries, M., & Probert, T. (2020). A linguistic analysis of spelling errors in Grade 3 isiXhosa home-language learners. Reading & Writing, 11(1), 1–10.

Daries, M., Probert, T., & Schaefer, M. (2021, August 7). The contributions of phonological awareness and decoding on spelling in isiXhosa Grade 3 readers. Retrieved from osf.io/cesgf

English spelling task

Makaure, P. (2021). The contributions of phonological processing skills to early literacy development in Northern Sotho-English bilingual children - a longitudinal investigation. University of South Africa.

9.3.3.3 A3.3.3: isiZulu and English: Individual Test

LITERACY – ISIZULU & ENGLISH
Grade 3 - end

Learner Unique ID:

Date of test: 2021/ /

Learner Name and Surname:

Learner is a

School:

Test development: MN Schaefer
Translation: Celani Zwane and Nthabiseng Tsotetsi

Recommended Citation:

Schaefer, M. (2021, July 27). Phonological processing skills and their longitudinal relation to first and additional language literacy in isiXhosa and isiZulu speaking children. https://doi.org/10.17605/OSF.IO/GMNWS

Data capture completed 2021/ / **by**

Comments:

Scoring:
Correct = 1
Incorrect = 0
Nonresponse = NA

Verbal Assent: Ngizokucela ukuthi ufunde manje. Ingabe lokhu kulungile?

Literacy: letter sound recognition Time start: 60s

Instructions for learner
Place chart 3 in front of the learner **Ngizokucela ukuthi ungifundele izinhlamvu ezithile zesiZulu. Ngitshele ukuthi uhlamvu ngalunye lwenza muphi umsindo. Funda izinhlamvu eziningi ukusukela kwesokunxele kuya kwesokudla njengakulesi sibonelo** (show example)**. Ngizokutshela ukuthi ume.** **Ingabe usulungile?** **Qala.** *Start timer (one minute) when you say start.* • ***Circle*** *the* ***last*** *letter read when the time ran out.* • *Place a* ***diagonal*** *line through the letters which are read* ***incorrectly****.* • ***CEILING:*** *Stop the task if the child makes* ***5 consecutive errors***

Chart 3

m	l	h	g	S	y	Z	W	p	n	10
L	th	T	c	b	a	hl	o	n	ng	20
i	b	th	M	U	sh	j	dl	K	u	30
g	R	B	kh	l	f	hl	M	s	kw	40
S	N	ph	B	p	v	k	a	E	D	50
R	A	t	P	f	sh	h	u	a	t	60
dw	G	H	B	S	l	g	m	i	j	70
B	dl	o	m	O	Y	E	N	p	t	80
g	K	B	ny	y	bh	Z	V	D	nc	90
f	s	ng	a	z	p	C	th	G	sw	100
V	ncw	q	h	nhl	g	sh	y	kh	t	110

SCORING – letter sound recognition			
1. Task discontinued		2. Number of errors	
3. Number of letters attempted		4. Time remaining	

Literacy: word reading fluency

Instructions for learner
Place chart 4 in front of learner. **Sicela ufunde la magama ngokuzwakalayo ngokusemandleni akho. Ngizokutshela ukuthi yima. Usukulungele? Qala.** • Record the total time taken to complete the task. Start the timer when you say start. • Indicate errors by placing a diagonal line through the word. • ***CEILING:*** *Stop the task if the child makes* ***5 consecutive errors and circle last item read.***

Chart 4

ya	abo	into	lala	beka
igama	amanzi	imoto	phuma	funa
vula	mela	usana	unyawo	wela
thwala	uthuli	intombazane	ufudu	usiba

SCORING – word reading fluency			
5. **Task discontinued**		6. **Total attempted**	
7. **number of errors**		8. **total time taken**	

Literacy: oral reading fluency[i]

60s

Instructions for learner:
Place chart 5 in front of the learner **Ngizokucela ukuthi ungifundele indaba ngezwi eliphezulu. Funda ngokwekhono lakho.** **Le indaba ethi "Isobho lamatshe"** **Ingabe usukulungele ukungifundela indaba ngezwi eliphezulu? Ngizokutshela ukuthi ume.** **Qala.** *Start timer when you say start. Record the incorrectly read words by placing a diagonal line through them. Circle the last word attempted after <u>1 minute</u>. **Discontinue if child cannot read first five words.** Allow two additional minutes for child to read up to question 5. Ask comprehension questions up to where the child read in three minutes.*

Chart 5

Isobho lamatshe	**words**
Kunesihambi esilambile (Q1).	2
Sahamba sicela emizini yabantu. Abantu babengenakho ukudla (Q2). Isihambi sathola isu.	12
Isihambi sathola ibhodwe. Sathatha amatshe sawafaka ebhodweni (Q3).	19
Sathela amanzi. Sabasa umlilo, sabeka ibhodwe eziko (Q4).	26
Sama salinda ibhodwe laze labila (Q5).	31
Kwafika intombazane yacela ukwazi ukuthi siphekani isihambi eziko.	39
"Ngipheka isobho elimnandi lamatshe.	43
Kodwa kumele ngilifake into ukuze linongeke," kusho isihambi.	51
"Nginezaqathe mina," wabe esenika isihambi. Sazifaka ebhodweni.	58

SCORING – oral reading fluency			
9. **Task discontinued**		10. **Number of errors**	
11. **Number of words attempted**		12. **Time remaining**	

Literacy: Reading comprehension[ii]

Umbuzo		Words read	Impendulo	Score
RC1.	1. Ngubani owayelambile?	2	Isihambi.	
RC2.	2. Yini abantu ababengenayo?	9	Babengenakho ukudla.	
RC3	3. Senzani isihambi ngamatshe?	19	Sawafaka ebhodweni. / Siyapheka.	
RC4	4. Yini enye into eyenziwa isihambi?	26	Sathela amanzi ebhodweni / sabasa umlilo / sabeka ibhodwe eziko.	
RC5	5. Sasimeleni isihambi eduze kwebhodwe?	31	Sasilinde ukuthi libile ibhodwe.	

Literacy: Diagnostic Test of Word Reading Processes (English)

Participants completed the Diagnostic Test of Word Reading Processes: nonwords, regular words and sight words. The instructions in the test manual were followed for administration.

Literacy: ORF – Jabu and his dog[iii]

English
Instructions for learner:
Place chart in front of the learner **I am going to ask you to read a story to me out loud. This is a story written in English so I will ask you to read it in English to me. Read as best you can. I will ask you some questions when you are finished reading so make sure to remember what you read. I will tell you when to stop reading.** **This story is called "How the elephant got its trunk".** **Are you ready to read the story to me out loud?** **Start.** *(Start from first word of story, not title)* *Start timer when you say start. Record the incorrectly read words by placing a diagonal line through them. Circle the last word attempted after* 1 minute. ***Discontinue if child cannot read first five words.*** *Allow two additional minutes for child to read up to question 5. Ask comprehension questions up to where the child read in three minutes.*

How the elephant got its trunk

In times long ago, elephants had short noses [Q1].	***8***
One day Bubu [Q2], the baby elephant, went for a walk through the forest [Q3].	***21***
He always wanted to know things, so he asked lots of questions.	***33***
He walked to the bank of a river.	***41***
He had never seen a crocodile before.	***48***
"Hello, Mr Crocodile [Q4]. What do you like to eat?" Bubu asked politely.	***60***
The crocodile grabbed the little elephant by his nose and pulled hard [Q5].	***72***
But Bubu fought back by spreading out his legs and pulling back.	***84***
At each pull his nose grew longer and longer.	***93***
At last the crocodile let go of the nose and swam away.	***105***
Instead of his short nose, Bubu now had a long trunk.	***116***
He could do all kinds of new things with it!	***126***
[126 words]	

SCORING – oral reading fluency			
13. **Task discontinued**		14. **Number of errors**	
15. **Number of words attempted**		16. **Total time taken if completed before 1 min**	

Literacy: Reading Comprehension[iv]

Question		**Word**	**Answer**	**Score**
Erc1	Long ago, did elephants have long or short noses?	8	short noses	
Erc2	In this story, what is the name of the elephant?	11	Bubu	
Erc3	Where did Bubu, the elephant, go for a walk?	21	through the forest OR by the river (banks)	
Erc4	Who did Bubu talk to at the river?	51	He spoke to a/the/Mr crocodile.	
Erc5	Why did the crocodile grab Bubu's nose?	72	He wanted to eat him.	

Grade 3 isiZulu & English - end

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[i] Reading comprehension questions after ORF test from Second Early Grade Reading Study. Department of Basic Education, & University of the Witwatersrand. (2020). *Early Grade Reading Study 2019, Wave 4*. DataFirst. https://doi.org/10.25828/h109-3y92

[ii] Reading comprehension questions after ORF test from Second Early Grade Reading Study. Department of Basic Education, & University of the Witwatersrand. (2020). *Early Grade Reading Study 2019, Wave 4*. DataFirst. https://doi.org/10.25828/h109-3y92

[iii] ORF test from Second Early Grade Reading Study. Department of Basic Education, & University of the Witwatersrand. (2020). *Early Grade Reading Study 2019, Wave 4*. DataFirst. https://doi.org/10.25828/h109-3y92

[iv] Reading comprehension questions after ORF test from Second Early Grade Reading Study. Department of Basic Education, & University of the Witwatersrand. (2020). *Early Grade Reading Study 2019, Wave 4*. DataFirst. https://doi.org/10.25828/h109-3y92

9.3.3.4 A3.3.4: isiZulu and English: Group Test

WRITTEN

LITERACY – ISIZULU & ENGLISH

Grade 3 - end

Learner Unique ID:

Date of test: 2021/ /

Learner Name and Surname:

School:

Data capture completed / / by

Scoring:
Correct = 1
Incorrect = 0
Nonresponse = NA

1

Isibizelo sesiZulu

Bhala lamagama owezwayo ngesiZulu eduze nenombolo ngayinye.

1.
2.
3.
4.
5.
6.
7.
8.
9.
10.

3

Mana.

Ungaliphenyi ikhasi ngaphambi kokuba ngikutshele ukuthi liphenye.

isiZulu - Imiyalelo

- Funda indaba engezansi bese uphendula imibuzo ezolandela.
- Unemizuzu eyi-15 ukuba uqede.
- Phendula yonke imibuzo ngokwekhono lakho.
- Uma uqeda ngaphambi kwesikhathi linda abanye beqembu.
- Ngizokutshela ukuba uliphenye nini ikhasi.

Kungani uMvubu engenaboya?

Ngelinye ilanga uNogwaja wayezihambela ngasemfuleni. UMvubu naye wayekhona lapho, ezihambela futhi ezidlela utshani obumnandi.

1. Wayehamba kuphi uMvubu kanye noNogwaja?

____

2. Yayidlani iMvubu?

____

UMvubu akazange abone ukuthi uNogwaja ukhona, wamnyathela unyawo ngephutha. Unogwaja wamemeza ethethisa uMvubu, "Wena Mvubu, awuboni yini ukuthi uyanginyathela?" UMvubu waxolisa kuye wathi, "Ngiyaxolisa mngani wami, angikubonanga." Kodwa uNogwaja akafunanga ukuzwa lutho, wathethisa uMvubu wathi, "Wenze ngabomu, ngelinye ilanga, uzobona! Uzokhokha!"

3. Wayemmemezelani Mvubu uNogwaja?

____
____

4

4. Kungani ucabanga ukuthi uMvubu akambonanga uNogwaja?

____

____

UNogwaja wahamba wayofuna uMlilo, wathi kuye, "Hamba, uma uMvubu ephuma emanzini eyodla utshani, ufike umshise. Unginyathelile!" UMlilo waphendula, "Akunankinga mngani wami, ngizokwenza lokhu ongicela khona." Langalimbe, uMvubu eyodla utshani kude nasemfuleni "whoosh!" uMlilo waphenduka amalangabi. Lawo malangabi aqala ashisa uboya buka Mvubu. UMvubu waqhala egijimela emanzini. Uboya bakhe bonke babushile emlilweni. Wayelokhu ekhala ethi, "Uboya bami bushile emlilweni! Ushise bonke uboya bami! Uboya bami obuhle kakhulu!" Yingakho uMvubu engadlaleli kude namanzi ngoba esaba ukuthi uzoshiswa wumlilo. Unogwaja wathokoza kakhulu ngenkathi uMvubu esha ethi, "Ngaze ngamthola!"

5. Kwenzekani ngoboya bukaMvubu?

____

6. Gcwalisa umusho olandelayo ngokukhetha igama eliyilo:

Ngicabanga ukuthi endabeni uNogwaja ukhombisa ukuthi uMvubu ________.

(a) uyaphana.
(b) akamfuni.
(c) akaxoleli.
(d) unothando.

Mana.

Ungaliphenyi ikhasi ngaphambi kokuba ngikutshele ukuthi liphenye.

Isibizelo seSingisi

Bhala lamagama owezwayo ngeSingisi eduze nenombolo ngayinye.

1.
2.
3.
4.
5.
6.
7.
8.
9.
10.

7

Mana.

Ungaliphenyi ikhasi ngaphambi kokuba ngikutshele ukuthi liphenye.

English – Imiyalelo

- Funda indaba ngezansi bese uphendula imibuzo elandelayo.
- Unemizuzu eyi-10 yokuqeda lo msebenzi.
- Phendula yonke imibuzo ngokwekhono lakho.
- Uma uqeda ngaphambi kwesikhathi linda abanye beqembu.
- Ngizokutshela ukuthi uliphenye nini ikhasi.


Jabu and his dog

Jabu had a little dog. It was a fat and happy dog. One day Jabu and his dog went to play in the fields behind the house.

1. What is the name of the boy in the story? ______________________

2. Where did the boy and dog go and play one day?

____

The little dog saw a rabbit and tried to chase it. The dog got lost.

3. What happened to the dog?

____

Jabu called him but he didn't come. Jabu got tears in his eyes and went home. But before evening the little dog came back. Jabu was very happy to see his friend.

4. Why did the boy have tears in his eyes?

____

References

Original story

Why Hippos have no hair
Author - Basilio Gimo and David Ker
Illustration - Carol Liddiment
Language - English
Level - First paragraphs
© Little Zebra Books 2014
Creative Commons: Attribution 4.0
Source www.africanstorybook.org
Original source http://www.littlezebrabooks.com/.

Reading comprehension tests used in Second Early Grade Reading Study.

Department of Basic Education, & University of the Witwatersrand. (2020). Early Grade Reading Study 2019, Wave 4. DataFirst. https://doi.org/10.25828/h109-3y92

isiZulu spelling task adapted and translated from

Daries, M., & Probert, T. (2020). A linguistic analysis of spelling errors in Grade 3 isiXhosa home-language learners. Reading & Writing, 11(1), 1–10.
Daries, M., Probert, T., & Schaefer, M. (2021, August 7). The contributions of phonological awareness and decoding on spelling in isiXhosa Grade 3 readers. Retrieved from osf.io/cesgf

English spelling task

Makaure, P. (2021). The contributions of phonological processing skills to early literacy development in Northern Sotho-English bilingual children - a longitudinal investigation. University of South Africa.

9.3.3.5 A3.3.5: Group Test Memorandum

Introduction to written assessment

English	isiZulu	isiXhosa
Instructions for learner:	Instructions for learner:	Instructions for learner:
Learners, we will now do some writing activities. Does everyone have a pencil? Have you all got books in front of you? Good. You will have time to do each activity. Read the stories silently, and then answer the questions. Do not turn the pages until we tell you to do so.	Bafundi, manje sizokwenza umsebenzi wokubhala. Ingabe wonke umuntu unepenseli? Ingabe nonke ninezincwadi phambi kwenu? Kuhle. Nizothola isikhathi sokwenza umsebenzi ngamunye. Fundani ngokuthula, bese niphendula imibuzo. Ningaphenyi ikhasi size sinitshele ukuthi nenze njalo.	Bafundi, sizakwenza imisebenzi yokubhala. Ingaba nonke ninazo ipensile?Nonke ninazo iincwadi phambi kwenu? Kulungile. Nizakunikwa ixesha lokwenza umsebenzi ngamnye. Funda lamabali ufundela phakathi ungakwazi, wandule ukuphendula imibuzo. Musa ukutyhila iphepha de uyalwelwe njalo.

10 mins

HL Spelling

English	isiZulu	isiXhosa
Instructions for learner:	Instructions for learner:	Instructions for learner:
Turn the page	Phenya ikhasi.	Tyhila iphepha
We will now complete a spelling test. I will say the word two times and I want you to write it down on the page. Even if you don't know how to write it, just try. Let's begin. [note to assistant: say each word twice with a pause in between. Watch that most children have completed the word then move on to the next one.]	Manje sesizoqedela isivivinyo sesibizelo. Igama ngalinye ngizolibiza kabili bese wena ulibhala phansi ekhasini lakho. Noma ngabe awnasiqiniseko ukuthi libhalwa kanjani, kodwa lizame. Masiqale.	Ngoku sizakukwenza uvavanyo lopelo. Ndizakulibiza igama kube kabini wandule ukulibhala phantsi kweli phepha. Kuzakufuneka uzame ukulibhala naxa ungaqinisekanga ukuba libhalwa njani. Masiqalise. [inqaku elibhekise kumncedisi: biza igama ngalinye kabini ngokunqumama phakathi. Qiniseka ukuba abantwana bayaligqiba igama ngaphambi kokuba badlulele kwelinye.]
1. Car 2. ear 3. but 4. yours 5. outside 6. eyes 7. first 8. today 9. eggs 10. inside	1. Imoto 2. indlebe 3. Kodwa 4. yakhe 5. Phandle 6. Amehlo 7. Kuqala 8. Namhlanje 9. Amaqanda 10. Ngaphakathi	1. **imoto** 2. **indlebe** 3. **kodwa** 4. **yakhe** 5. **phandle** 6. **amehlo** 7. **kuqala** 8. **namhlanje** 9. **amaqanda** 10. **ngaphakathi**

1

2

12 mins

HL written comprehension

English	isiZulu	IsiXhosa
Instructions for learner:	Instructions for learner:	Instructions for learner:
Turn the page	Phenya ikhasi	Tyhila iphepha
We will now complete a written comprehension activity where we read a story in [language] and then answer some questions at the end.	Manje sizoqedela umsebenzi wesifundo sokuqondisisa lapho sifunda khona indaba ngesiZulu bese siphendula imibuzo ekugcineni.	Siza kugqibezela umsebenzi obhaliweyo wokuqonda apho sifunda ibali [ngolwimi] size siphendule imibuzo ethile ekugqibeleni.
Let's read the instructions: - read the story below and answer the questions that follow it - you have 12 minutes to finish - answer all the questions as best as you can - If you finish early wait for the rest of the group - I will tell you when to turn the page Do you have any questions?	Asifunde imiyalelo: - funda indaba engezansi bese uphendula imibuzo ezolandela - unemizuzu eyi-12 ukuba uqede - phendula yonke imibuzo ngokwekhono lakho - Uma uqeda ngaphambi kwesikhathi linda abanye beqembu - Ngizokutshela ukuba uliphenye nini ikhasi	Masifunde imiyalelo: -Funda eli bali lingezantsi wandule ukuphendula imibuzo elandelayo. -Unemizuzu elishumi elinesibini lokugqiba lo msebenzi -Phendula imibuzo kangangoko unako -Xa ugqibe kwangoko linda amanye amalungu eqela -Ndizakukuxelela xa kufuneka utyhile iphepha

Begin.	Ingabe unemibuzo? Qala.	Unayo imibuzo? Qalisa.

isiZulu Story – How the hippo lost his fur (African Storybook Project) - Kungani uMvubu engenaboya?

African Storybook project – By Gimo and Ker

Ngelinye ilanga unogwaja wayezihambela ngasemfuleni. UMvubu naye wayekhona lapho, ezihambela futhi ezidlela utshani obumnandi. UMvubu akazange abone ukuthi unogwaja ukhona, wamnyathela unyawo ngephutha. Unogwaja wamemeza ethethisa uMvubu, "Wena Mvubu, awuboni yini ukuthi uyanginyathela?" UMvubu waxolisa kuye wathi, "Ngiyaxolisa mngani wami, angikubonanga." Kodwa unogwaja akafunanga ukuzwa lutho, wathethisa uMvubu wathi, "Wenze ngabomu, ngelinye ilanga, uzobona! Uzokhokha!" Unogwaja wahamba wayofuna uMlilo, wathi kuye, "Hamba, uma uMvubu ephuma emanzini eyodla utshani, ufike umshise. Unginyathelile!" UMlilo waphendula, "Akunankinga mngani wami, ngizokwenza lokhu ongicela khona." Langalimbe, uMvubu eyodla utshani kude nasemfuleni "whoosh!" uMlilo waphenduka amalangabi. Lawo malangabi aqala ashisa uboya buka Mvubu. UMvubu waqhala egijimela emanzini. Uboya bakhe bonke babushile emlilweni. Wayelokhu ekhala ethi, "Uboya bami bushile emlilweni! Ushise bonke uboya bami! Uboya bami obuhle kakhulu!" Yingakho uMvubu engadlaleli kude namanzi ngoba esaba ukuthi uzoshiswa wumlilo. Unogwaja wathokoza kakhulu ngenkathi uMvubu esha ethi, "Ngaze ngamthola!"

isiXhosa Story – How the hippo lost his fur (African Storybook Project) – Kutheni imvubu ingenaboya?

African Storybook project. Translated to isiXhosa by N Nyakambi.

Ngenye imini umvundla wayezihambela ngasemlanjeni. UMvubu wayekhona naye, ezihambela ezityela nengca emnandi.

UMvubu akabonanga ukuba uMvundla nawo wayelapho, wamnyathela elunyaweni ngempazamo. UMvundla wathethela phezulu engxola ebhekise kuMvubu, "Mvubu, awuboni na ukuba uyandinyathela?" Waxolisa uMvubu wathi "Uxolo mhlobo wam, khange ndikubone. "Akafunanga nokuva uMvundla, waqhubeka engxolisa uMvubu wathi, "Wenze ngabom, ngenye imini ndizakubonisa! Uzobhatala!"

UMvundla wahamba wayofuna uMlilo, wathi kuye "Hamba, uye kulinda uMvubu xa ephume emanzini eyokutya ingca, kulapho ke wena uzakufika umtshise khona. Undinyathele! "Waphendula uMlilo, "Akukho ngxaki mhlobo wam,ndizakwenza kanye ngokwesicelo sakho." Ngenye imini uMvubu wathi esazityela ingca kude nasemfuleni "whoosh!" uMlilo wajika wavutha amadangatye. Lo madangatye aqalisa ukutshisa uboya bukaMvubu. UMvubu wabaleka wayoziphosa emanzini. Uboya bakhe bonke babutshile ngumlilo. Wayekhala esithi "uboya bam butshiswe ngumlilo! Ubutshise bonke uboya bam! Uboya bam obuhle kangaka!" Yilonto uMvubu esoloko edlalela kufutshane namanzi kuba woyika ukuphinda atshiswe ngumlilo kwakhona. UMvundla wavuya kakhulu ngelixa ebona uMvubu etshiswa ngumlilo wathi, "Ndikufumene nam!"

Questions

	English	isiZulu	isiXhosa
1.1.	Q: Where were Hippo and Rabbit walking? A: by the riverside, on the grass Also accept: by the river, Do not accept vague answers or repetition of question.	Q: Wayehamba kuphi uMvubu kanye noNogwaja? A: ngasemfuleni, otshanini Yamukela futhi: emfuleni, Ungamukeli izimpendulo ezingezwakali noma ukuphindwa kombuzo.	Q: Babehamba phi uMvubu noMvundla? A: Babehamba ngasemlanjeni, engceni Yamnkelekile nempendulo ethi: emlanjeni Ungazamnkeli iimpendulo ezingavakaliyo okanye ukuphindwa kombuzo.
1.2.	Q: What was Hippo eating? A: grass Only accept a word for "grass" –	Q: Yayidlani iMvubu? A: utshani Yemukela kuphela igama "utshani" –	Q: Wayesitya ntoni uMvubu? A: ingca Yamnkela naliphi na igama elichaza "ingca"

	English	isiZulu	isiXhosa
1.3.	Q: Why did Rabbit scream/shout at Hippo? A: Rabbit was hurt/ Hippo stood on Rabbit's foot/ The answer must show that Rabbit was hurt when Hippo stood on Rabbit. Accept either: - Rabbit was hurt, - Rabbit was angry, - Hippo stood on Rabbit Unacceptable response: repetition of question or unrelated to the story e.g. Rabbit felt like it.	Q: Wayemmemezelani Mvubu uNogwaja? A: UNogwaja wayezwa ubuhlungu/ uMvubu wayeme phezu konyawo lukaNogwaja/ Impendulo kumele iveze ukuthi uNogwaja wayezwa ubuhlungu ngenkathi uMvubu ime phezu konyawo lwakhe. Yemukela: - UNogwaja wayezwa ubuhlungu, - UNogwaja wayethukuthele, - UMvubu wayenyathele uNogwaja Impendulo engagculisi: ukuphindwa kombuzo noma okungahambisani nendaba isib. uNogwaja wezwa kanjalo.	Q: Wayemngxoliselani uMvundla uMvubu? A: UMvundla wayesezintlungwini, enomsindo ngokunyathelwa kwakhe phezu konyawo nguMvubu. Impendulo mayibonakalise ukuba uMvundla wayesezintlungwini akuba enyathelwe nguMvubu elunyaweni. Yamnkela neyiphi kwezi iimpendulo: -UMvundla wayesezintlungwini, -UMvundla wayenomsindo, -UMvubu wayenyathele uMvundla Impendulo engavumelekanga: kukuphindwa kombuzo okanye impendulo engenanto yakwenza nebali umz. UMvundla wenza oko kungekho sizathu soko.

	English	isiZulu	isiXhosa
1.4.	Q: Why do you think Hippo didn't see Rabbit? A: Hippo is bigger than Rabbit/ he was enjoying eating the grass and not paying attention to where he was walking/ Rabbit was behind Hippo Answer must give a reason why Hippo might not have seen Rabbit. Unacceptable response: repetition of question or unrelated to the story e.g. Hippo was blind. Hippo was lying.	Q: Kungani ucabanga ukuthi uMvubu akambonanga uNogwaja? A: UMvubu mkhulu kunoNogwaja/ wayejabulela ukudla utshani anganakanga lapho ahamba khona/ uNogwaja wayengemuva kwaMvubu Impendulo kumele inikeze isizathu sokuthi kungani uMvubu angambonanga uNogwaja. Impendulo engagculisi: ukuphindwa kombuzo noma okungahambisani nendaba isib. UMvubu wayeyimpumputhe. UMvubu wayeqamba amanga.	Q: Ucinga ukuba yintoni eyenza ukuba uMvubu angamboni uMvundla? A: Umvubu mkhulu kunoMvundla/ ingqondo yakhe yayisekutyeni ingca hayi kwindawo awayehamba kuyo/ UMvundla wayesemva koMvubu. Impendulo mayibonakalise isizathu esabangela uMvubu angamboni uMvundla. Impendula engavumelekanga: kukuphindwa kombuzo okanye impendulo engenanto yakwenza nebali umz. UMvubu wayeyimfama. UMvubu wayexoka.

	English	isiZulu	isiXhosa
1.5.	Q: What happened to Hippo's fur? A: It was burned, Rabbit sent fire to burn him Answer must relate to the story. His fur was burned off. Unacceptable response: repetition of question or unrelated to the story e.g. Hippo never had fur. Hippo's don't have fur.	Q: Kwenzekani ngoboya bukaMvubu? A: basha, uNogwaja wathumela uMlilo ukuthi amshise Impendulo kumele ihambisane nendaba. Uboya bakhe basha. Impendulo engagculisi: ukuphindwa kombuzo noma okungahambisani nendaba isib. UMvubu ayikaze ibe noboya. BoMvubu abanabo uboya.	Q: Kwenzeka ntoni kuboya bukaMvubu? A: Batsha, uMvundla wathumela uMlilo ukuba amtshise. Impendulo mayibhekisele ebalini. Uboya bakhe batshiswa. Impendulo engavumelekanga: kukuphindwa kombuzo okanye impendulo engenanto yakwenza nebali umz. UMvubu wayengenabo uboya. UMvubu akanaboya.

	English	isiZulu	isiXhosa
1.6.	Q: Complete the following sentence by choosing the best option below: I think that in the story, rabbit shows that he is __________ to Hippo. a. Generous b. Hippo doesn't want him (Rabbit) c. Unforgiving d. Loving Correct answer: **c** (also accept if student writes out answer c in the space provided rather than filling in the circle) Unacceptable response: more than one option selected in multiple choice.	Q: Gcwalisa umusho olandelayo ngokukhetha igama eliyilo: Ngicabanga ukuthi endabeni uNogwaja ukhombisa ukuthi uMvubu ________ a. Uyaphana b. Akamfuni c. Akaxoleli d. Unothando Correct answer: **c** (also accept if student writes out answer c in the space provided rather than filling in the circle) Unacceptable response: more than one option selected in multiple choice.	Q: Gqibezela esi sivakalisi silandelayo ngokukhetha impendulo echanileyo kwezi zilandelayo: Ngokwalapha ebalini, ndicinga ukuba uMvundla wabonisa _______kuMvubu. a. Ubuntu b.UMvubu akamfuni u(Mvundla) c.Ukungabi naxolo d.Uthando Correct answer: **c** (also accept if student writes out answer c in the space provided rather than filling in the circle) Impendulo echanileyo: **c** (ungamnkela xa umfundi ebhale unobumba c kwisithuba esinikeziweyo kunokuzalisa isagqa. Unacceptable response: more than one option selected in multiple choice. Impendulo engavumelekanga: xa kukhethwe iimpendulo zangaphezulu kwesinye kuluhlu lweempendulo ezinikeziweyo.

English Spelling

10 mins

English	isiZulu	isiXhosa
Instructions for learner:	Instructions for learner:	Instructions for learner:
Turn the page	Phenya ikhasi.	Tyhila iphepha
We will now complete a spelling test in English. I will say the word two times and I want you to write it down on the page. Even if you don't know how to write it, just try. Let's begin. [note to assistant: say each word twice with a pause in between. Watch that most children have completed the word then move on to the next one.]	Manje sesizoqedela isivivinyo sesibizelo ngeSingisi. Igama ngalinye ngizolibiza kabili bese wena ulibhala phansi ekhasini lakho. Noma ngabe awunasiqiniseko ukuthi libhalwa kanjani, kodwa lizame. Masiqale.	Ngoku siza kugqibezela uvavanyo lopelo ngesiNgesi. Ndizakulibiza igama kube kabini wandule ukulibhala phantsi kweli phepha. Kuzakufuneka uzame ukulibhala naxa ungaqinisekanga ukuba libhalwa njani. Masiqalise. [inqaku elibhekise kumncedisi: biza igama ngalinye kabini ngokunqumama phakathi Qiniseka ukuba abantwana bayaligqiba igama ngaphambi kokuba badlulele kwelinye.]
1. Pen 2. Fish 3. Sound 4. cough 5. Brown 6. Stream 7. Walked 8. Special 9. Mountain	1. Pen 2. Fish 3. Sound 4. cough 5. Brown 6. Stream 7. Walked 8. Special 9. Mountain	1. Pen 2. Fish 3. Sound 4. cough 5. Brown 6. Stream 7. Walked 8. Special 9. Mountain
10. Elephant	10. Elephant	10. Elephant

9

10

English written comprehension

8 mins

English	isiZulu	isiXhosa
Instructions for learner:	Instructions for learner:	Instructions for learner:
Turn the page	Phenya ikhasi	Tyhila iphepha
We will now read an English story and then answer some questions about it.	Manje sesizofunda indaba yesiZulu bese siphendula imibuzo ethile ngayo.	Ngoku siza kufunda ibali lesiNgesi sandule ukuphendula imibuzo ebhekisela kulo.
Let's read the instructions: - read the story below and answer the questions that follow it - you have 8 minutes to finish - answer all the questions as best as you can. - If you finish early wait for the rest of the group - I will tell you when to turn the page Do you have any questions? Begin. You have 8 minutes to read the story and answer all the questions. If you finish early you can put your head on the desk and sleep.	Asifunde imiyalelo elandelayo: - funda indaba ngezansi bese uphendula imibuzo elandelayo - unemizuzu eyi-8 yokuqeda lo msebenzi - phendula yonke imibuzo ngokwekhono lakho. - Uma uqeda ngaphambi kwesikhathi linda abanye beqembu - Ngizokutshela ukuthi uliphenye nini ikhasi Ingabe kukhona imibuzo onayo? Qala. Unemizuzu eyi-8 yokufunda indaba nokuphendula yonke imibuzo. Uma uqeda ngaphambi kwesikhathi ungalala edesikini.	Masifunde imiyalelo: -funda ibali elingezantsi wandule ukuphendula imibuzo elandelayo -Unemizuzu esibhozo yokugqiba lo msebenzi -Phendula yonke imibuzo kangangoko unako. -Ukuba ugqibe kuqala linda amanye amalungu eqela -Ndakukuxelela xa kufuneka utyhile iphepha Ingaba ikhona imibuzo onayo? Qalisa. Unemizuzuz esibhozo yokufunda eli bali wandule ukuphendula yonke imibuzo. Ukuba ugqibe kuqala ungaqubuda iintloko yakho edesikeni ulale.

10

Jabu and his dog (74 words)

Jabu had a little dog. It was a fat and happy dog.

One day Jabu and his dog went to play in the fields behind the house.

The little dog saw a rabbit and tried to chase it.

The dog got lost.

Jabu called him but he didn't come.

Jabu got tears in his eyes and went home.

But before evening the little dog came back.

Jabu was very happy to see his friend.

11

Question		Answer	Notes
2_1	What is the name of the boy in the story?	Jabu	Only acceptable answer; spelling must be correct
2_2	Where did the boy and dog go and play one day?	In the fields (veld) / behind Jabu's house	**Accept also**: fields, veld, **Unacceptable:** outside, garden, inside, in the house; repetition of question
2_3	What happened to the dog?	He got lost.	**Accept also:** he ran away **Unacceptable:** answer unrelated to story (e.g. he died) or repetition of question
2_4	Why did the boy have tears in his eyes?	He was sad/was crying because his dog was lost/he could not find his dog.	**Accept also**: he did not know what to do; he was alone **Unacceptable:** answer not related to story e.g. someone hit him, he was a crybaby, he was very happy the dog was gone; repetition of question or repeated sentence from story e.g. "Jabu got tears in his eyes and went home"

12

9.3.4 A3.4: Home background questionnaire

isiZulu/English Home background questionnaire

1. q1_Fieldworker conducting survey

2. q2_Learner Unique ID

3. q3_Uyavuma ukuba yinxenye yocwaningo nokuthi umncwaningi asebenzise ulwazi omnike lona njengenxenye yocwaningo lwakhe? / Do you agree to be part of the survey and for the researcher to use this data as part of her research?

   Yebo / Yes

   Fona ngesinye isikhathi/ Phone me another time (skip to 4)

   Cha / No

4. q4_What day would suit you? can choose more than one

   - Sunday / iSonto
   - Monday / UMsombuluko
   - Tuesday / ULwesibili
   - Wednesday / ULwesithathu
   - Thursday / ULwesine
   - Friday / uLwesihlanu
   - Saturday / UMgqibelo

5. q5_What time would suit you better? can choose more than one

1

- between 9am - 12pm
- between 12 and 1 in the after...
- between 1 and 2 in the afternoon
- between 2 and 5 in the afternoon
- after 5pm

6. q6_Alternate phone number

7. q7_Igama lomntwana. / Child's name

8. q8_Isibongo somtnwana. / Child's surname

9. q9_Ingabe uyalwazi usuku umntwana azalwa ngalo? / Do you know the birth date of the child?
   - Yebo
   - Cha

q10_Usuku / Day
q11_Inyanga / Month

- January / uMasingane
- February / uNhlolanja
- March / uNdasa
- April / uMbaso
- May / uNhlaba
- June / uNhlangula
- July / uNtulikazi
- August / uNcwaba
- September / uMandulo
- October / uMfumfu
- November / uLwezi
- December / Zibandlela

12. q12_Unyaka

- 2011
- 2012
- 2013

13. q13_Igama lakho [okhulumayo] / What is your name?

14. q14_Ingabe nguwena yini umbhekeleli womntwana? / Are you the person who mainly looks after the child?

- Yebo
- Cha

q15_Ngubani okunguyena umbhekeleli womntwana? / Who mainly looks after this child?

- Umama / mother

- ubaba/ father
- ugogo / grandmother
- umkhulu / grandfather
- usisi/ sister
- ubhuti / brother
- anti/malume / aunt/uncle
- ngomunye umumntu / someone else

15. q16_Unabudlelwano buni nomntwana? / How are you related to this child?

- Umama / mother
- ubaba/ father
- ugogo / grandmother
- umkhulu / grandfather
- usisi/ sister
- ubhuti / brother
- anti/malume / aunt/uncle
- ngomunye umumntu / someone else

16. q17_Mingaki iminyaka yombhekeleli womntwana? / What is the age of this main caregiver?

- younger than 18
- 18 - 25
- 26 - 30
- 31 - 40
- 41 - 50
- 51 - 60
- older than 60

17. q18_Ngubani ohlala nomntwana isikhathi esiningi? / Who does the child live with most often?
(choose all that apply)

- Umama / mother
- ubaba/ father
- ugogo / grandmother
- umkhulu / grandfather
- usisi/ sister
- ubhuti / brother
- anti/malume / aunt/uncle
- ngomunye umumntu / someone else

18. q19_Unawo umatikuletsheni? / Do you have matric?

- Yebo
- Cha

19. q20_Wathola ezinye iziqu emva kukamatikuletsheni? / Did you get a qualification after matric?

- Yebo
- Cha

20. q21_Wagcina ngamuphi unyaka esikoleni? / What grade did you leave school?

q22_Isiphi isiqu onaso owasithola emva kokuqeda umatikuletsheni? / What is the highest qualification you have completed after matric?

- Isitifiketi / Certificate
- IDiploma / Diploma

- Undergraduate degree
- Postgraduate degree 1

21. q23_Ingabe kukhona umsebenzi okade uwenza kulamaviki amabili adlulile ozokuholela? / During the past two weeks, did you do any work for which you will receive a salary/ wage/ or any other form of payment?

- Yebo
- Cha

22. q24_Uma ukhona, bekunguhlobo luni lomsebenzi? / What work did you do (job title)?

q25_Ingabe ninazo lezi zinto ezilandelayo ekhaya? / Do you have any of the following things in your home ? (select all that apply)

- Ugesi / electricity
- Umabonakude/TV
- Umsakazo/ Radio
- IKhompuytha/laptop
- Ifriji/ isiqandisi / fridge
- Indlu yangasese eflashwayo / flushing toilet inside the house
- Isisefo ngaphakathi endlini / running water inside the house
- Umakhalekhukhwini / cellphone
- Ibhayisikili / bicycle
- Imoto / car

23. q26_Ucabanga ukuthi ngubani okufanele abophezeleke ngemfundo yomntwana wakho? / Who do you think is most responsible for your child's education?

- abazali / parents
- abafundisi/ othisha / teachers
- Umphakathi / the community
- uhulumeni / the government

- Other

24. q27_Iyiphi inyanga ngo2020 umntwana abuyela ngayo esikoleni? / What month in 2020 (last year) did your child go back to school?
    - January
    - February
    - March
    - April
    - May
    - June
    - July
    - August
    - September
    - October
    - November
    - December
    - I don't know/remember

25. q28_Iziphi izinto enizenze nomntwana ngonyaka odlule ngesikhathi esasekhaya eziphathelene nokufunda ngonyaka ka2020? / While your child was at home during lockdown in 2020, what educational activities did you do with your child? (choose all that apply)
    - Umsebenzi abawunikwe ngothisha / work sent by teacher
    - Izinhlezo zokufunda emsakazo/ educational radio programs
    - Izinhlelo zokufunda kumabonakude/TV/ education TV programs
    - Ngamenzela mina umsebenzi angawenza wesikole / I created educational work
    - Lutho/ ngangingenaso isikhathi/ nothing / I did not have time

26. q29_Luthini uhlelo lomntwana wakho lokufunda ngonyaka ka2021? / What is the schooling arrangement with your child in 2021?
    - Umntwana uya njalo esikoleni / every day
    - Uya njalo ngelanga lesibili esikoleni/ every second day
    - Uya njalo evikini lesibili esikoleni/ every second week
    - Other

27. q30_Ngesikhathi umntwana wakho esekhaya kulonyaka ka2021, yiziphi izinto abazenzayo eziphathelene nesikole uma kungesilo ithuba labo lokuthi baye esikoleni? / While your child is at home this year (2021), what educational activities do they do when it is not their turn at school?

- Umsebenzi abawunikwe ngothisha / work sent by teacher
- Izinhlezo zokufunda emsakazo/ educational radio programs
- Izinhlelo zokufunda kumabonakude/TV/ education TV programs
- Ngamenzela mina umsebenzi angawenza wesikole / I created educational work
- Lutho/ ngangingenaso isikhathi/ nothing / I did not have time

28. q31_Uma ucabanga ukhuvethe lube nomthelela kangakanani mayelana nezinhlelo zokufunda komntwana wakho? / How do you think the COVID-19 pandemic and related school closures have affected your child's education?

- Indlela aqhuba ngayo ezifundweni ivele yayimbi kakhulu / performance got worse
- Akubanga nashintsho / no change
- Indlela aqhuba ngayo ezifundweni ibengcono / performance was better
- Anginaso isiqiniseko / I'm not sure

29. q32_Ingabe kukhona nje izincwadi ozifundela zona uchithe isizungu(hhayi ibhayibheli)? / Do you read any books for fun (not the Bible)?

- Yebo
- Cha

30. q33_Ingabe ikhona I-Library emphakathini ohlala kuwo? / Is there a library in your community?

- Yebo
- Cha

31. q34_Ingabe kukhona izincwadi owake waziboleka e-Library? / Have you borrowed books from the library?

- Yes
- No

32. q35_Ingabe umfundela kangakanani umntwana wakho izincwadi? / How often do you read to your child?

- Akwenzeki / never
- Kanye ngeviki / once a week
- Ngivamisile ukumfundela kaningi / most days
- Nsukuzonke / every day

33. q36_Iziphi izilimi ojwayele ukufundela ngazo umntwana uma ngabe usumfundela? / What languages do you read in most often when reading to your child?

- isiXhosa
- English
- isiZulu
- Afrikaans
- Sepedi
- other
- I don't read to my child

34. q37_Ingabe Ujwayele ukukufundela kangakanani umntwana wakho? / How often does your child read to you?

- Akwenzeki / never
- Kanye ngeviki / once a week
- Ngivamisile ukumfundela kaningi / most days
- Nsukuzonke / every day

35. q38_Ingabe yena ujwayele ukukufundela ngaziphi izilimi kakhulu? / What language does s/he read to you in most often?

- isiXhosa
- English
- isiZulu

- Afrikaans
- Sepedi
- other
- my child does not read to me

36. q39_Ingabe zingaki izincwadi zezindaba zabantwana ezikhona ekhaya? Ungabala nazithole esikoleni uma kungezakhe umntwana? / How many children story books are there at your home? You can include books from school if they belong to your child.

- No books
- 1-5 books
- 6-10 books
- 11-25 books
- more than 25 books

37. q40_Zingaki izincwadi ezinye ezikhona ekhaya? Ungabala nanoma ezaluphi ulimi. / How many other books are there at your home? You can include books in any language.

- No books
- 1-5 books
- 6-10 books
- 11-25 books
- more than 25 books

38. q41_Ingabe ujwayele kangakanani ukuthenga omagazini kanye nephephandaba? Ungabala nanoma ibaphi omagazini namaphephandaba abhalwe ngezinye izilimi. / How often do you buy magazines or newspapers? You can include magazines/newspapers in any language.

- never
- once every few months
- once a week
- more than once a week

39. q42_Ingabe ongumbhekeleli womntwana uzisebenzisa kangakanani lezi zilimi ukukhuluma nomntwana ekhaya? / How often does the main caregiver use these languages to speak to this child at home?

Ngisebenzisa lolulimi ukuze ngikhulume nalomfundi
kakhulu / most of the time
Izikhathi eziningana / half the time
Ngaleso sikhathi / some of the time
Angilokothi / never

q42_isiXhosa
q42_English
q42_isiZulu
q42_Afrikaans
q42_Sepedi
q42_other

40. q43_Ingabe umntwana uzisebenzisa kangakanani lezi zilimi ekhaya? / How often does the child use these languages at home?

I only use this language
most of the time
half the time
some of the time
never

q43_isiXhosa
q43_English
q43_isiZulu
q43_Afrikaans
q43_Sepedi
q43_Other

41. q44_Ingabe umfundi ulizwa kangakani lolulimi emphakathini ahlala kuwo? / How often does this learner hear this language in the community where they live?

I only use this language most of the time half the time some of the time never
q43_isiXhosa
q43_English
q43_isiZulu
q43_Afrikaans
q43_Sepedi
q43_Other

42. q45_Uma umfundi elalela umsakazo noma ebukela umabonakude/TV ingabe izinhlelo zisuke zikhulunywa ngaluphi ulimi? / When the child listens to the radio or watches TV, what languages are the programs in?

- programs are only in this language
- most of the time
- half the time
- some of the time
- never

q45_English

q45_isiXhosa

q45_isiZulu

q45_Sepedi

q45_Other

q45_Afrikaans

43. q46_Ingabe umntwana uyasazi isiXhosa? / Does the child understand isiXhosa?

- Yebo
- Cha

44. q47_How well can the child...

- not at all
- not very good
- not good
- good
- very good

q47_understand someone speaking in this language?

q47_speak in this language? / Ingabe ukwazi kangakanani umntwana ukukhuluma ngalolulimi?

q47_read in this language? / Ingabe ukwazi kangakanani umntwana ukufunda ngalolulimi?

q47_write in this language? / Ingabe ukwazi kangakanani umntwana ukubhala ngalolulimi?

45. q48_At what age did the child first use this language? / Wayeneminyaka emingaki umntwana ngesiskhathi eqala ukusebenzisa lolulimi?

46. q49_Where is the language used MOST OFTEN by the child? / Ingabe lolulimi umntwana ulisebenzisa kuphi isikhathi esiningi?

- at home / ekhaya
- at school / esikholweni
- in my community e.g. church / Emphakathini isibonelo: esontweni
- in the shops / ezitolo
- she/he only uses this language

47. q50_Ingabe umntwana uyasazi isiZulu? / Does the child understand isiZulu?

- Yebo / Yes
- Cha / No

48. q51_How well can the child...

■ not at all ■ not very good ■ not good ■ good ■ very good

q51_understand someone speaking in this language?

q51_speak in this language? / Ingabe ukwazi kangakanani umntwana ukukhuluma ngalolulimi?

q51_read in this language? / Ingabe ukwazi kangakanani umntwana ukufunda ngalolulimi?

q51_write in this language? / Ingabe ukwazi kangakanani umntwana ukubhala ngalolulimi?

49. q52_At what age did the child first use this language? / Wayeneminyaka emingaki umntwana ngesiskhathi eqala ukusebenzisa lolulimi?

50. q53_Where is the language used MOST OFTEN by the child? / Ingabe lolulimi umntwana ulisebenzisa kuphi isikhathi esiningi?

at home / ekhaya	26
at school / esikholweni	10
in my community e.g. church /...	1
in the shops / ezitolo	0
she/he only uses this languag...	0

51. q54_Ingabe umntwana uyasazi isiNgisi? / Does the child understand English?

Yebo / Yes

Cha / No

52. q55_How well can the child...

■ not at all ■ not very good ■ not good ■ good ■ very good

q55_understand someone speaking in this language?

q55_speak in this language? / Ingabe ukwazi kangakanani umntwana ukukhuluma ngalolulimi?

q55_read in this language? / Ingabe ukwazi kangakanani umntwana ukufunda ngalolulimi?

q55_write in this language? / Ingabe ukwazi kangakanani umntwana ukubhala ngalolulimi?

53. q56_At what age did the child first use this language? / Wayeneminyaka emingaki umntwana ngesiskhathi eqala ukusebenzisa lolulimi?

q57_Where is the language used MOST OFTEN by the child? / Ingabe lolulimi umntwana ulisebenzisa kuphi isikhathi esiningi?

- at home / ekhaya
- at school / esikholweni
- in my community e.g. church /...
- in the shops / ezitolo
- she/he only uses this languag...

54. q58_Ingabe umntwana uyayazi i-Afrikaans / Does the child understand Afrikaans?

- Yes / Yebo
- No / Cha

55. q59_How well can the child...

not at all | not very good | not good | good | very good

q59_understand someone speaking in this language?

q59_speak in this language? / Ingabe ukwazi kangakanani umntwana ukukhuluma ngalolulimi?

q59_read in this language? / Ingabe ukwazi kangakanani umntwana ukufunda ngalolulimi?

q59_write in this language? / Ingabe ukwazi kangakanani umntwana ukubhala ngalolulimi?

56. q60_At what age did the child first use this language? / Wayeneminyaka emingaki umntwana ngesiskhathi eqala ukusebenzisa lolulimi?

57. q61_Where is the language used MOST OFTEN by the child? / Ingabe lolulimi umntwana ulisebenzisa kuphi isikhathi esiningi?

- at home / ekhaya
- at school / esikholweni
- in my community e.g. church /...

- in the shops / ezitolo
- she/he only uses this languag...

58. q62_Ingabe umntwana uyasazi iSepedi? / Does the child understand Sepedi?

- Yes / Yebo
- No / Cha

59. q63_How well can the child...

- not at all
- not very good
- not good
- good
- very good

q63_understand someone speaking in this language?

q63_speak in this language? / Ingabe ukwazi kangakanani umntwana ukukhuluma ngalolulimi?

q63_read in this language? / Ingabe ukwazi kangakanani umntwana ukufunda ngalolulimi?

q63_write in this language? / Ingabe ukwazi kangakanani umntwana ukubhala ngalolulimi?

60. q64_At what age did the child first use this language? / Wayeneminyaka emingaki umntwana ngesiskhathi eqala ukusebenzisa lolulimi?

q65_Where is the language used MOST OFTEN by the child? / Ingabe lolulimi umntwana ulisebenzisa kuphi isikhathi esiningi?

- at home / ekhaya
- at school / esikholweni
- in my community e.g. church /...
- in the shops / ezitolo
- she/he only uses this languag...

61. q66_Uyazazi yini umntwana ezinye izilimi ngaphandle kwalezi esesikhulume ngazo? / Do you want us to record another language?

- Yebo / Yes

Cha / No

62. q66.1_what is the other language?

63. q67_How well can the child... not at all not very good not good good very good

q67_understand someone speaking in this language?

q67_speak in this language? / Ingabe ukwazi kangakanani umntwana ukukhuluma ngalolulimi?

q67_read in this language? / Ingabe ukwazi kangakanani umntwana ukufunda ngalolulimi?

q67_write in this language? Ingabe ukwazi kangakanani umntwana ukubhala ngalolulimi?

64. q68_At what age did the child first use this language? / Wayeneminyaka emingaki umntwana ngesiskhathi eqala ukusebenzisa lolulimi?

65. q69_Where is the language used MOST OFTEN by the child? / Ingabe lolulimi umntwana ulisebenzisa kuphi isikhathi esiningi?

at home / ekhaya

at school / esikholweni

in my community e.g. church /...

in the shops / ezitolo

she/he only uses this languag...

66. q70_Ingabe uyasazi isiXhosa? / Do you understand isiXhosa?

Yebo / Yes

Cha/ No

67. q71_How well can you...

not at all not very good not good good very good

q71_understand someone speaking in this language? / Ungathi umuzwa kangakanani umuntu okhuluma...

q71_speak in this language? / Ukwazi kangakanani ukukhuluma lolulimi?

q71_read in this language? / Ukwazi kangakanani ukufunda lolulimi?

q71_write in this language? / Ukwazi kangakanani ukubhala lolulimi?

68. q72_At what age did you first use this language? / Waqala uneminyaka emingaki ukukhuluma lolulimi? Insights

69. q73_Where is the language used MOST OFTEN by you? / Ingabe ulisebenzisa kuphi kakhulu lolulimi?

- at home / ekhaya
- at work / emsebenzini
- in my community e.g. church /...
- in the shops / ezitolo
- I only use this language

70. q74_Ingabe uyasazi isiZulu? / Do you understand isiZulu?

- Yebo / Yes
- Cha / No

71. q75_How well can you...

not at all | not very good | not good | good | very good

q75_understand someone speaking in this language? / Ungathi umuzwa kangakanani umuntu okhuluma...

q75_speak in this language? / Ukwazi kangakanani ukukhuluma lolulimi?

q75_read in this language? / Ukwazi kangakanani ukufunda lolulimi?

q75_write in this language? / Ukwazi kangakanani ukubhala lolulimi?

72. q76_At what age did you first use this language? / Waqala uneminyaka emingaki ukukhuluma lolulimi?

q77_Where is the language used MOST OFTEN by you? / Ingabe ulisebenzisa kuphi kakhulu lolulimi?

- at home / ekhaya
- at work / emsebenzini
- in my community e.g. church /...
- in the shops / ezitolo

I only use this language

73. q78_Ingabe uyasazi isiNgisi? / Do you understand English?

Yebo / Yes

Cha / No

74. q79_How well can you...

not at all not very good not good good very good

q79_understand someone speaking in this language? / Ungathi umuzwa kangakanani umuntu okhuluma...

q79_speak in this language? / Ukwazi kangakanani ukukhuluma lolulimi?

q79_read in this language? / Ukwazi kangakanani ukufunda lolulimi?

q79_write in this language? / Ukwazi kangakanani ukubhala lolulimi?

75. q80_At what age did you first use this language? / Waqala uneminyaka emingaki ukukhuluma lolulimi?

q81_Where is the language used MOST OFTEN by you? / Ingabe ulisebenzisa kuphi kakhulu lolulimi?

at home / ekhaya

at work / emsebenzini

in my community e.g. church /...

in the shops / ezitolo

I only use this language

76. q82_Ingabe uyayazi i-Afrikaans / Do you understand Afrikaans?

Yebo / Yes

Cha / No

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77. q83_How well can you...

■ not at all ■ not very good ■ not good ■ good ■ very good

q83_understand someone speaking in this language? / Ungathi umuzwa kangakanani umuntu okhuluma...

q83_speak in this language? / Ukwazi kangakanani ukukhuluma lolulimi?

q83_read in this language? / Ukwazi kangakanani ukufunda lolulimi?

q83_write in this language? / Ukwazi kangakanani ukubhala lolulimi?

78. q84_At what age did you first use this language? / Waqala uneminyaka emingaki ukukhuluma lolulimi?

79. q85_Where is the language used MOST OFTEN by you? / Ingabe ulisebenzisa kuphi kakhulu lolulimi?

- at home / ekhaya
- at work / emsebenzini
- in my community e.g. church /...
- in the shops / ezitolo
- I only use this language

80. q86_Ingabe uyasazi iSepedi? / Do you understand Sepedi?

- Yebo / Yes
- Cha / No

81. q87_How well can you...

■ not at all ■ not very good ■ not good ■ good ■ very good

q87_understand someone speaking in this language? Ungathi umuzwa kangakanani umuntu okhuluma lez...

q87_speak in this language? / Ukwazi kangakanani ukukhuluma lolulimi?

q87_read in this language? / Ukwazi kangakanani ukufunda lolulimi?

q87_write in this language? / Ukwazi kangakanani ukubhala lolulimi?

82. q88_At what age did you first use this language? / Waqala uneminyaka emingaki ukukhuluma lolulimi?

83. q89_Where is the language used MOST OFTEN by you? / Ingabe ulisebenzisa kuphi kakhulu lolulimi?

at home / ekhaya 2

at work / emsebenzini 0

in my community e.g. church /... 11

in the shops / ezitolo 0

I only use this language 0

84. q90_Ingabe Uyazazi ezinye izilimi ngaphandle kwalezi esesikhulume ngazo? (that you speak) / Is there any other language we haven't mentioned?

Insights

yebo / yes 14

cha / no 22

85. q91_What other language do you want us to record? / Yiluphi olunye ulimi ofuna silubhale phansi?

86. q92_How well can you...

not at all   not very good   not good   good   very good

q92_understand someone speaking in this language? / Ungathi umuzwa kangakanani umuntu okhuluma...

q92_speak in this language? / Ukwazi kangakanani ukukhuluma lolulimi?

q92_read in this language? / Ukwazi kangakanani ukufunda lolulimi?

q92_write in this language? / Ukwazi kangakanani ukubhala lolulimi?

87. q93_At what age did you first use this language? / Waqala uneminyaka emingaki ukukhuluma lolulimi?

88. q94_Where is the language used MOST OFTEN by you? / Ingabe ulisebenzisa kuphi kakhulu lolulimi?

at home / ekhaya

at work / emsebenzini

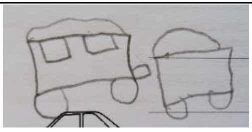
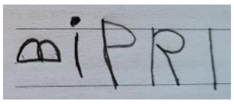
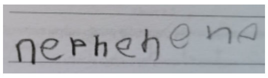
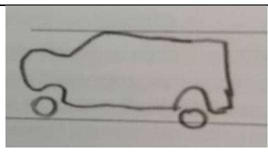
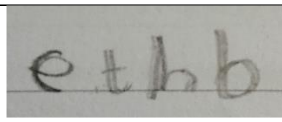
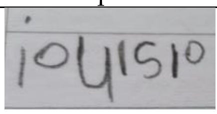
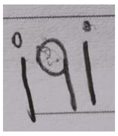
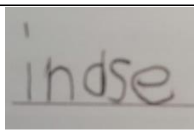
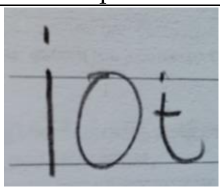
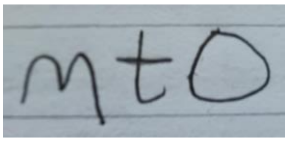
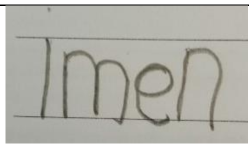
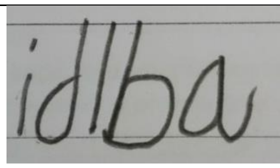
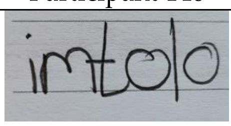
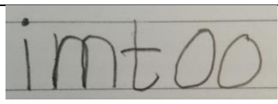
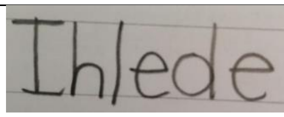
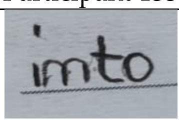
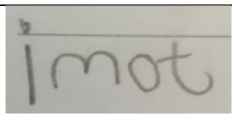
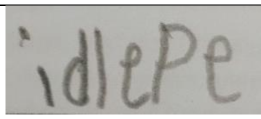
- in my community e.g. church /...
- in the shops / Ezitolo
- I only use this language

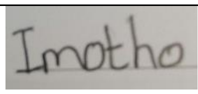
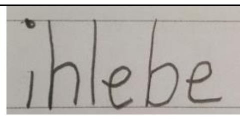
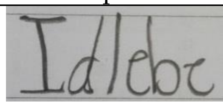
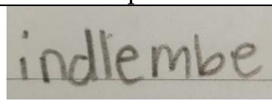
89. q95_Did the parent request to end the survey early?

- Yes
- No

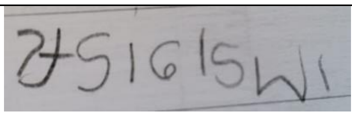
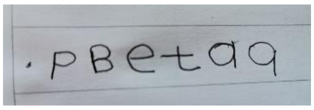
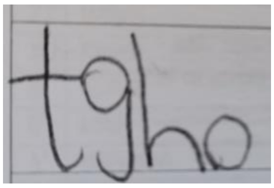
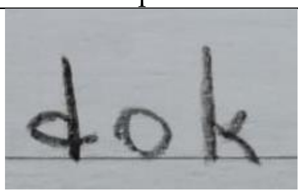
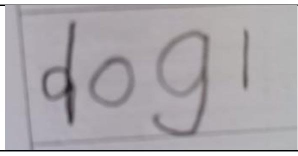
9.4 A4: SPELLING – PARTIAL SCORING EXAMPLES

9.4.1 A.4.1: Examples of L1 partial scoring

Partial Scoring Value	Grade 1 Example *imoto* max 6	Grade 3 Example *imoto* max 6	Grade 3 Example *indlebe* max 8
0	 Participant 119  Participant 100  Participant 035	 Participant 122	 Participant 005
1	 Participant 026  Participant 042	 Participant 110	 Participant 096
2	 Participant 128  Participant 140	 Participant 128	 Participant 097
3	 Participant 133	 Participant 139	 Participant 133
4	 Participant 059	 Participant 116	 Participant 135

Partial Scoring Value	Grade 1 Example *imoto* max 6	Grade 3 Example *imoto* max 6	Grade 3 Example *indlebe* max 8
5	Imonto Participant 112	 Participant 078	 Participant 127
6	-	-	 Participant 137
7	-	-	 Participant 017

9.4.2 A.4.2: Examples of English partial scoring

Partial Scoring Value	Grade 1 and 3 Example *dog* max 4	Grade 3 Example *sheep* max 6
0	 Participant 056  Participant 100  Participant 042	cmifot Participant 004 wm Participant 51
1	dac Participant 054	thip Participant 015
2	 Participant 052	sep Participant 002 shme Participant 016
3		shP Participant 019

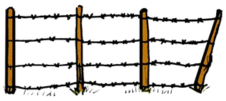
Partial Scoring Value	Grade 1 and 3 Example *dog* max 4	Grade 3 Example *sheep* max 6
	Participant 111	ship Participant 78
4		shiep Participant 29 shepp Participant 72
5	-	shep participant 47

9.5 A5: List of changes made to PPVT-IV Form A

In this appendix, I list the changes made to Form A of the PPVT-IV in adapting it to isiXhosa and isiZulu. All target items in Form A were translated into the relevant L1 term and used as items in the adapted test, unless specified below. Some distractors were also replaced and these are noted below.

Item 14. *Waffle* (distractor) replaced by *a slice of cake* (distractor).

Item 30. The illustration of a wooden fence (target) was replaced by an illustration of a wire fence (target).



Item 31. Target item changed. *Full* was used instead of *empty*.

Item 35. Target item changed. L1 translation of *squirrel* was difficult to find so target was changed to *mouse* (4), and *possum* (2) was covered by a *rabbit* picture

Item 41. Target item changed. The word for *cobweb* is multiword in L1 so the item was changed to *shell* (3).

Item 49. *Peek* translated as *look*.

Item 54. Target item changed. *Diamond* (1) with image of *rectangle* from item 29; word for diamond in L1 is multiword and unknown to children.

Item 58. *Panda* changed to *bear* – no word in L1.

Item 59. *Vest* changed to *jacket* (1).

Item 62. Target (2) changed to skateboard (4)

Item 64. *Knight* changed to *soldier* and picture of knight replaced with a picture of a soldier on a horse

Item 66. *Cactus* changed to *bush/shrub* (1). *Tree* (4) replaced with a picture of a single flower. Distractors could not be chosen as a new target because the word for tree and bush is the same in Zulu (isihlahla).

Item 67. *Dentist* (3) changed to *injection* (4) because the L1 translation for dentist is multiword.

Item 68. *Floating* (2) changed to *dive* (1) as the word for *float* and *swim* are the same in isiXhosa. Picture 3 was replaced by an image of a child walking in water (3) from item 47.

Item 72. *Furry* was changed to *fur*.

Item 78. *Squash* (4) changed to cabbage (2).

Item 80. *Flamingo* replaced by image of a *stork* (3), and *stork* was the new item.

Item 84. *Vegetable* (3) changed to *nut* (2).

Item 88. *Timer* (1) replaced by image of *clock* and item changed to *clock*.

Item 91. Vase (4) changed to trophy (2).

Item 95. *Swamp* (2) changed to *waterfall* (3).

Item 97. *Pigeon* changed to *dove*. Same image used.

Item 99. *Flaming* changed to *flames*. Same image used.

Item 106. Image 4 replaced by image of a ship. *Canoe* (2) changed to *ship* (4).

Item 115. *Hydrant* (4) changed to *sprinkler* (3).

Item 123. *Assisting* (2) changed to *stretching* (4).

Item 130. In isiZulu test only. *Tusk* (1) changed to *antler* (4) as L1 translation of tusk is horn and applies to all distractors. Item 135 used in isiXhosa test as a replacement item.