

Letter-sound by letter-sound: making sense of written texts in the early grades. Evidence from alphabetic languages in South Africa.

Carien Wilsenach

Inaugural lecture

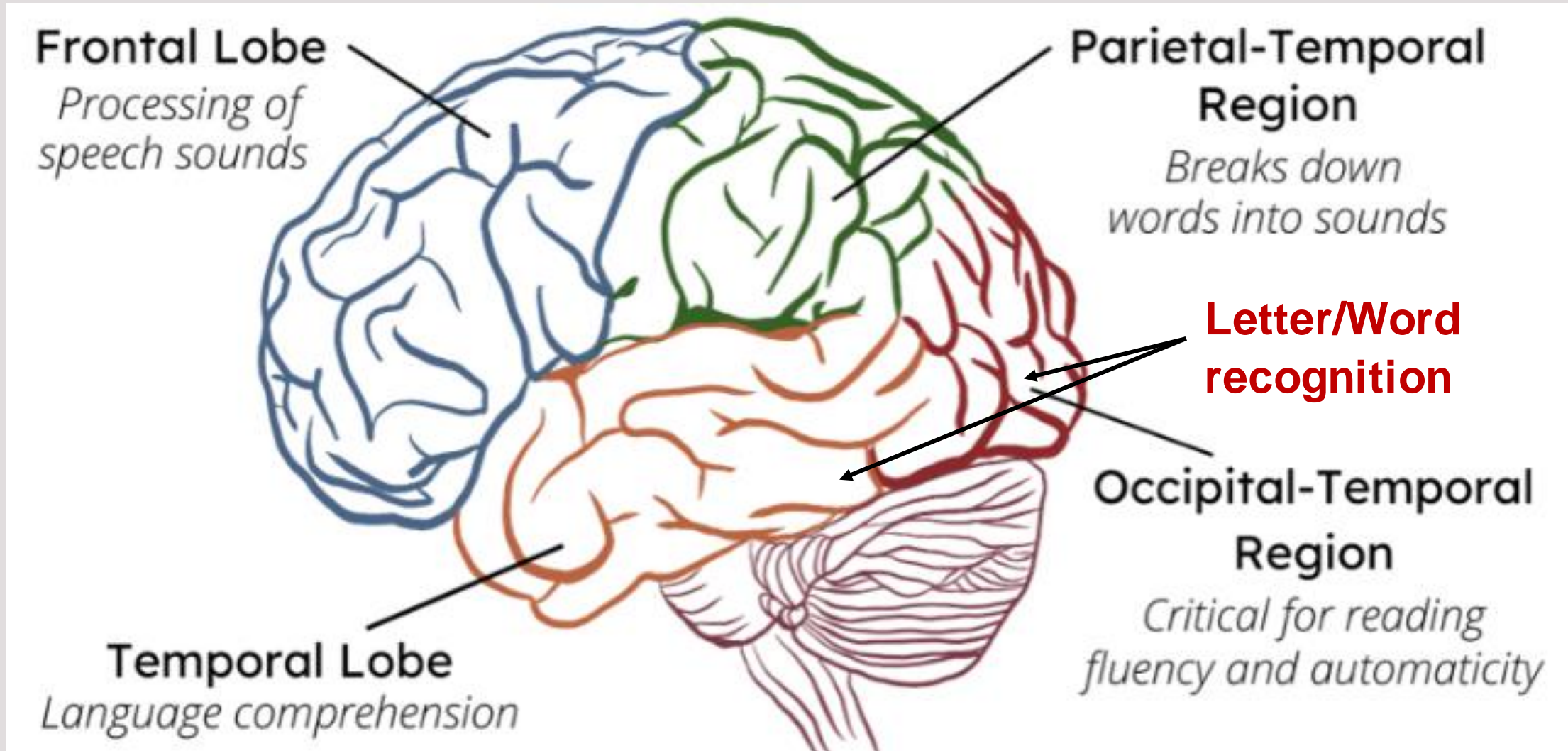
16 March 2023

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The reading brain



<https://www.scholastic.com/teachers/teaching-tools/articles/professional-development/science-of-reading-brain.html>

Structure of the rest of my lecture

- Background context: foundations of reading, reading statistics in South Africa and the reading wars
- Cognitive-linguistic skills as predictors of reading development
- Evidence from Northern Sotho, isiZulu and isiXhosa: the importance of developing cognitive-linguistic skills and early literacy skills in the ECD and foundation phase
- Implications for reading instruction in African languages

Foundations of literacy development

- Wide range of linguistic skills
 - **phonological (processing) skills** (associated with decoding)
 - **morphological (processing) skills** (associated with decoding and comprehension))
 - **Vocabulary, syntax, and discourse** skills (associated with comprehension and inference)
 - Knowledge of **phoneme-grapheme (letter-sound) correspondences**
- Knowledge of print
 - **Letter** knowledge (alphabetic knowledge)
 - Experience with **wide range of printed text**
- Children from high-poverty communities are at risk of not developing foundational skills at age-appropriate times:
 - Lagging in development of foundation skills

Reading statistics in South Africa: PIRLS 2016

Exhibit 1.2: Multiple Comparisons of Average Reading Achievement

PIRLS 2016 4th Grade

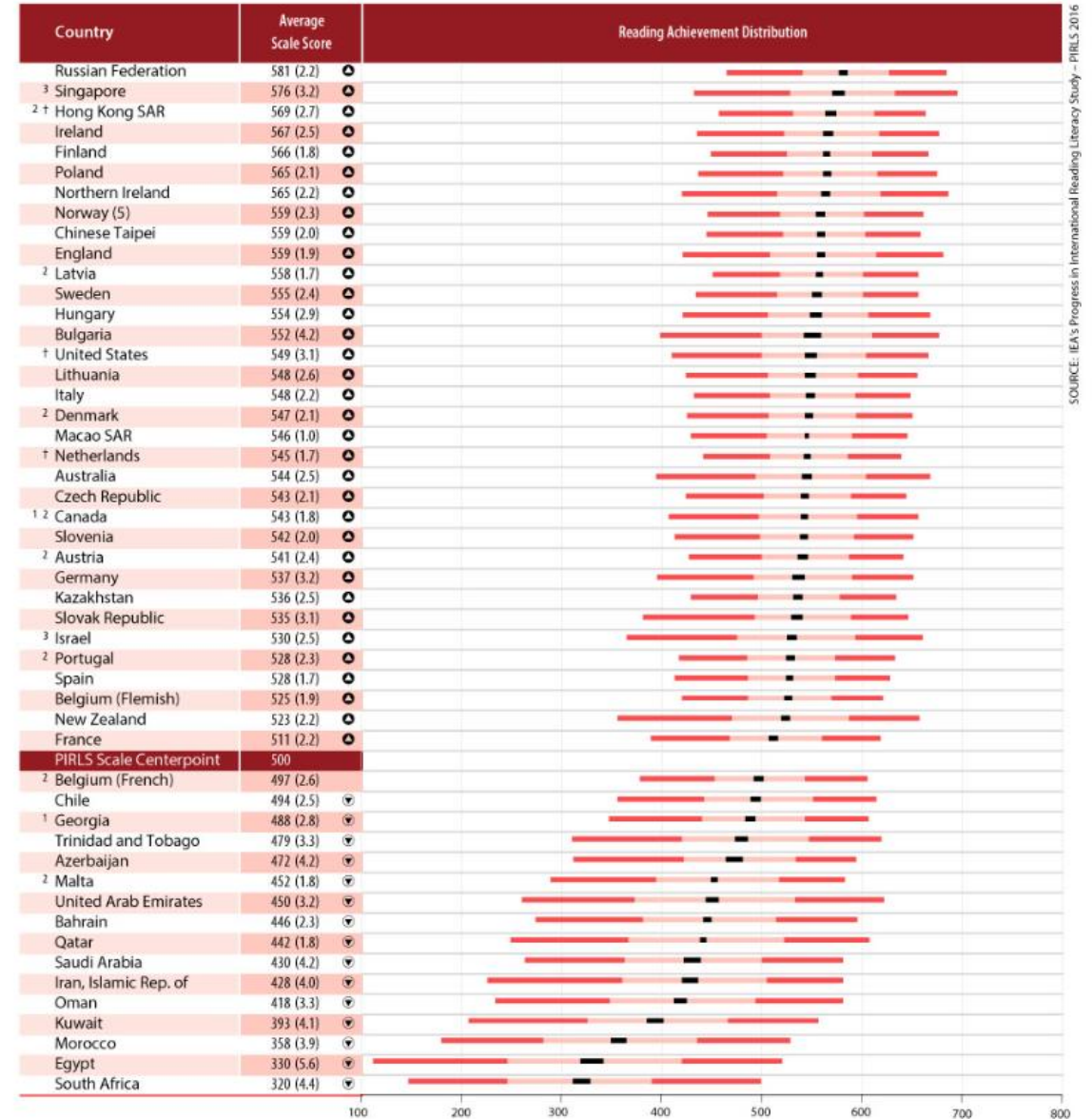
Instructions: Read across the row for a country to compare performance with the countries listed along the top of the chart. The symbols indicate whether the average achievement of the country in the row is significantly lower than that of the comparison country, significantly higher than that of the comparison country, or if there is no statistically significant difference between the average achievement of the two countries.

Country	Average Scale Score	Russian Federation	Singapore	Hong Kong SAR	Ireland	Finland	Poland	Northern Ireland	Norway (5)	Chinese Taipei	England	Latvia	Sweden	Hungary	Bulgaria	United States	Lithuania	Italy	Denmark	Macao SAR	Netherlands	Australia	Czech Republic	Canada	Slovenia	Austria	Germany	Kazakhstan	Slovak Republic	Israel	Portugal
Russian Federation	581 (2.2)																														
Singapore	576 (3.2)																														
Hong Kong SAR	569 (2.7)																														
Ireland	567 (2.5)																														
Finland	566 (1.8)																														
Poland	565 (2.1)																														
Northern Ireland	565 (2.2)																														
Norway (5)	559 (2.3)																														
Chinese Taipei	559 (2.0)																														
England	559 (1.9)																														
Latvia	558 (1.7)																														
Sweden	555 (2.4)																														
Hungary	554 (2.9)																														
Bulgaria	552 (4.2)																														
United States	549 (3.1)																														
Lithuania	548 (2.6)																														
Italy	548 (2.2)																														
Denmark	547 (2.1)																														
Macao SAR	546 (1.0)																														
Netherlands	545 (1.7)																														
Australia	544 (2.5)																														
Czech Republic	543 (2.1)																														
Canada	543 (1.8)																														
Slovenia	542 (2.0)																														
Austria	541 (2.4)																														
Germany	537 (3.2)																														
Kazakhstan	536 (2.5)																														
Slovak Republic	535 (3.1)																														
Israel	530 (2.5)																														
Portugal	528 (2.3)																														
Spain	528 (1.7)																														
Belgium (Flemish)	525 (1.9)																														
New Zealand	523 (2.2)																														
France	511 (2.2)																														
PIRLS Scale Centerpoint	500																														
² Belgium (French)	497 (2.6)																														
Chile	494 (2.5)																														
¹ Georgia	488 (2.8)																														
Trinidad and Tobago	479 (3.3)																														
Azerbaijan	472 (4.2)																														
² Malta	452 (1.8)																														
United Arab Emirates	450 (3.2)																														
Bahrain	446 (2.3)																														
Qatar	442 (1.8)																														
Saudi Arabia	430 (4.2)																														
Iran, Islamic Rep. of	428 (4.0)																														
Oman	418 (3.3)																														
Kuwait	393 (4.1)																														
Morocco	358 (3.9)																														
Egypt	330 (5.6)																														
South Africa	320 (4.4)																														

SOURCE: IEA's Progress in International Reading Literacy Study - PIRLS 2016

Exhibit 1.1: Distribution of Reading Achievement

PIRLS 2016 4th Grade



SOURCE: IEA's Progress in International Reading Literacy Study - PIRLS 2016

Reading statistics in South Africa

- New data sets based on intervention studies of the DBE and literacy NGOs (e.g. Funda Wandu, Nali Bali) of over 40,000 South African learners (2010-2022) show more than 50% of children do not know the letters of the alphabet by the end of Grade 1.
 - these children remain behind, and are forever ‘catching up’; although the high drop-out rate from public schools (between 42%-56%) suggest many of these learners never catch up.
 - (750,000 learners dropped out of school during the Covid-19 pandemic, about three times the pre-pandemic level.)*

Academic vocabulary

- Phonics: the relationship between letters (or letter groups) and single sounds in a language, and the ability to apply knowledge of letter-sound correspondences to read text
- Phoneme: a single speech sound
- Grapheme: the written representation of a single speech sound
- Phonological awareness: ability to recognise and manipulate the sounds in spoken language
- Blending: joining together individual sounds into words
- Segmenting: separating the sounds in a word
- Syllabification: dividing a word in parts that contain a vowel
- Orthography: conventions for writing a language, including spelling rules
- Alphabetic principle: letters corresponds to sounds

Abbreviations

- HL: home language
- L1: first language
- PP: Phonological processing
- PA: phonological awareness
- PWM: phonological working memory
- RAN: rapid autonomous naming
- LSF: letter-sound fluency

The reading wars

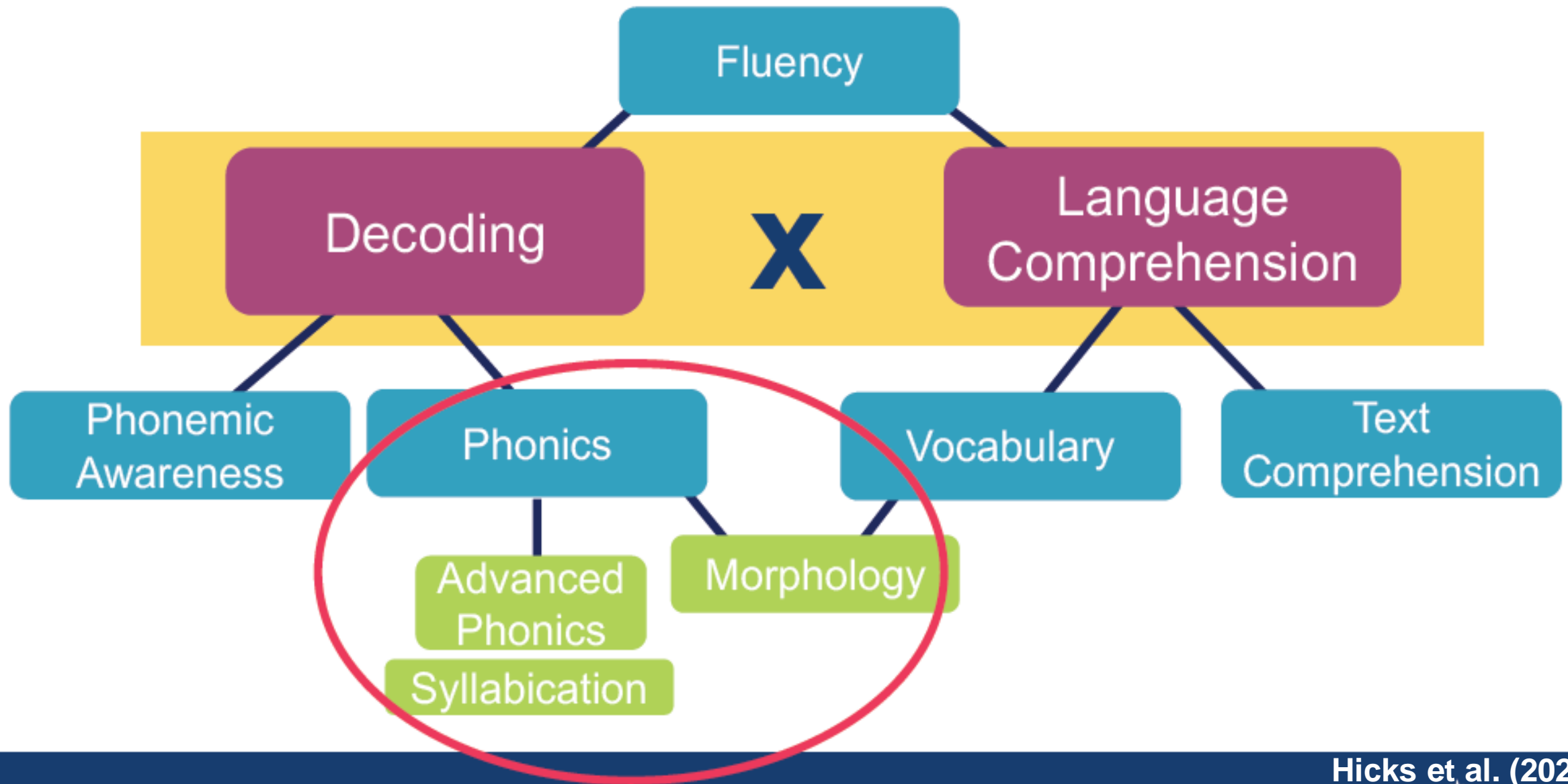
Phonics-based reading instruction

- a method for teaching young children to read and spell words.
- instructor introduces (spelling) rules and teaches the child to apply phonetics (how the letter combinations sound out loud)
- children learn to decode words based on their spellings
- children learn rules and exceptions, and they are not taught to memorize words.
- phonics (attempts to) break written language down into small and simple components

Whole language reading instruction

- a method of teaching children to read by recognizing words as whole pieces of language.
- language should not be broken down into letters and combinations of letters and “decoded”; learning to read is analogous to reading to speak, and is best fostered through natural immersion.
- words function in a context, and if they are decoded separately the meaning of a text gets lost.
- children memorize words so that they can recognize them on sight. These are called “sight words.”

The simple view of reading



Cognitive-linguistic skills and reading

Cognitive-linguistic skills:

lexical knowledge (vocabulary skills)

phonological processing

-phonological awareness

-phonological short-term memory

-automaticity in processing (rapid naming)

Letter-sound knowledge (phonics)

morphological awareness

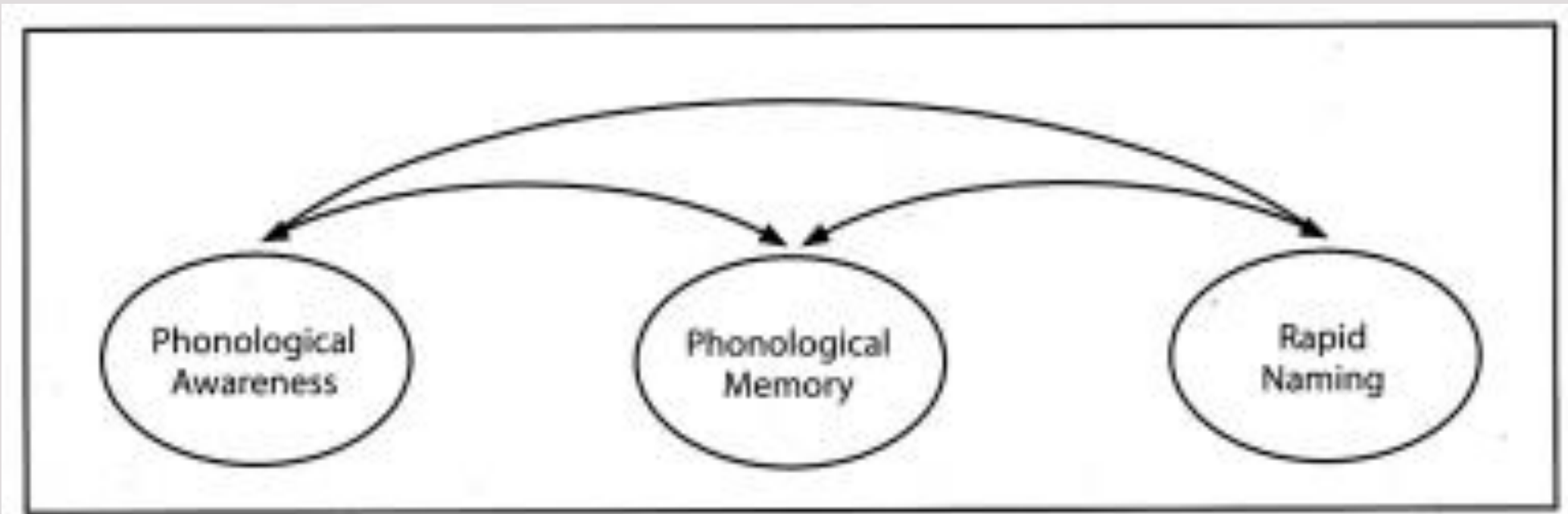
syntactic knowledge

critical thinking and inferencing

- Research into the role that these skills play at various stages of literacy develop in the South African languages has been neglected.

Phonological processing skills and reading

- Phonological processing is an auditory processing skill that represents the ability to process phonological aspects of the auditory signal.
- Phonological processing mode: Wagner & Torgesen (1987)
- Three interrelated components



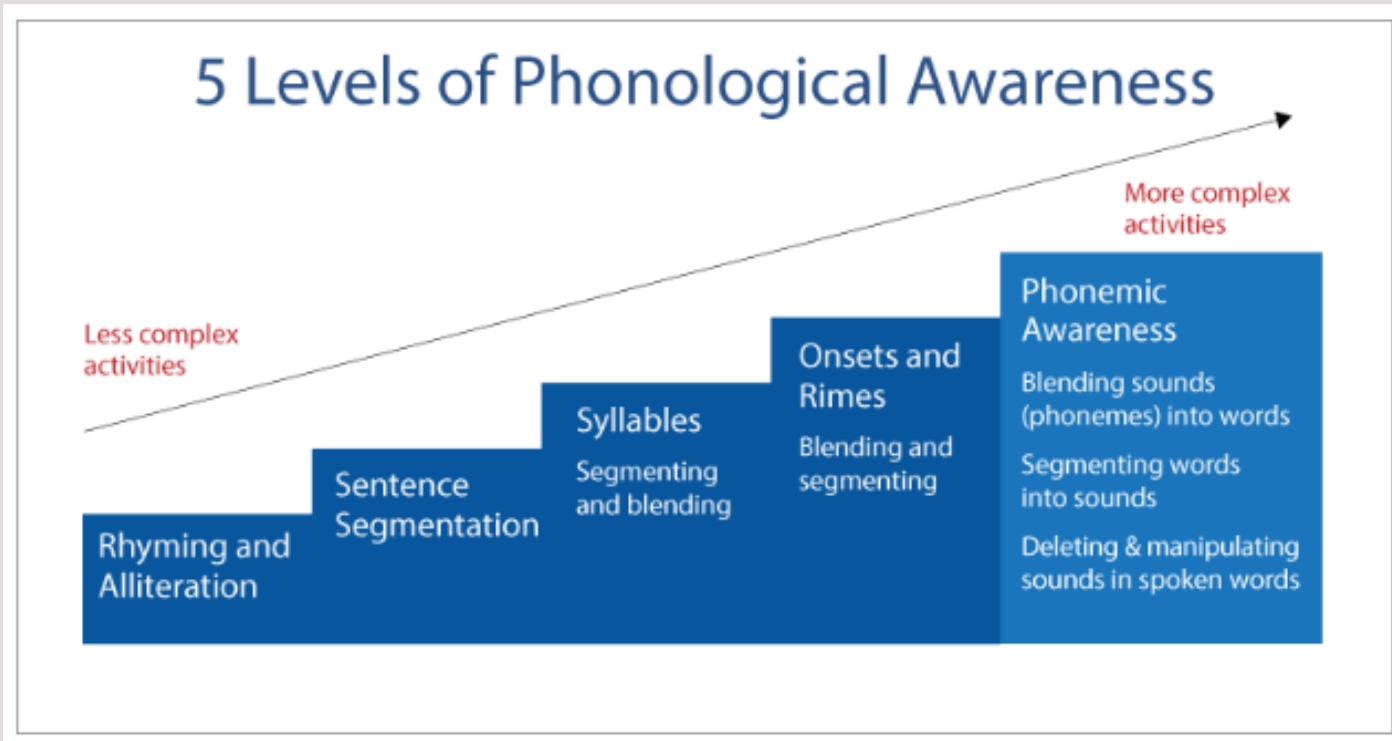
Phonological awareness (PA) and reading

- Phonological awareness skills it facilitates an individual's ability to **distinguish, analyse and manipulate the sound units that constitute words**
- PA is crucial for reading development, regardless of the phonological and orthographic structure of a language because...
 - this ability *allows beginning readers to associate sound units of varying 'grain sizes' (i.e. phonemes, onsets, rimes and syllables) with graphemes, and ensures the formation of stable phoneme-grapheme correspondences* (Goswami 2010).
- In other words, readers need phonological awareness skills in order to grasp the **alphabetic principle** (i.e. that letters on a page correspond to sounds in a language)

Phonological awareness and reading

- The levels of PA that are associated with reading development are ‘phoneme awareness’, ‘onset-rime awareness’ and ‘syllable awareness’.
- **Syllable awareness**
 - *cowboy* can be segmented into two syllabic components /*cow*/ and /*boy*/.
- **Onset-rime awareness**
 - *cat* can be divided into /*c*/ (onset) and /*at*/ (rime).
- **Phoneme awareness**
 - *cat* can be split into the phonemes /*k*/, /*æ*/, and /*t*/, corresponding to the letters “c”, “a”, “t”.

Phonological awareness and reading



<https://www.readingrockets.org/teaching/reading-basics/phonemic>

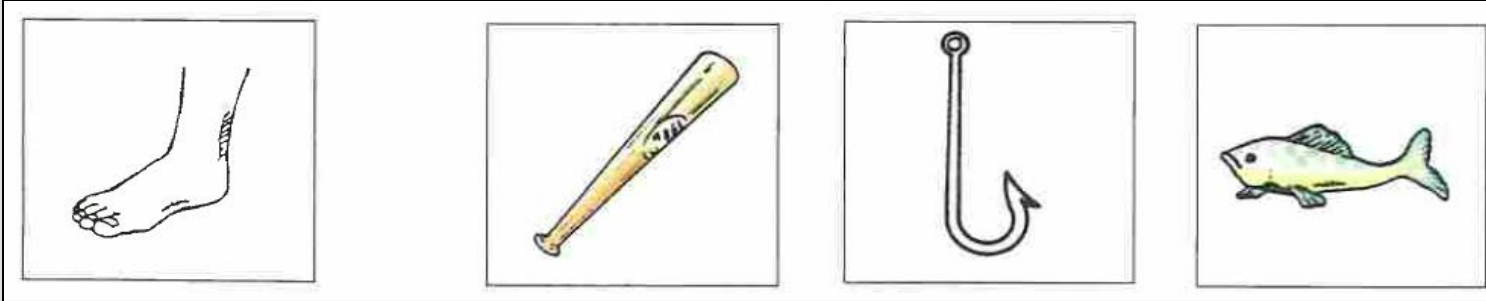
- Depending on the structure of a particular language, the last three levels of PA are differentially related to reading acquisition.
- Poor PA skills lead to poor decoding skills, which in turn affects children's reading fluency.

PA in relation to phonological and orthographical structure

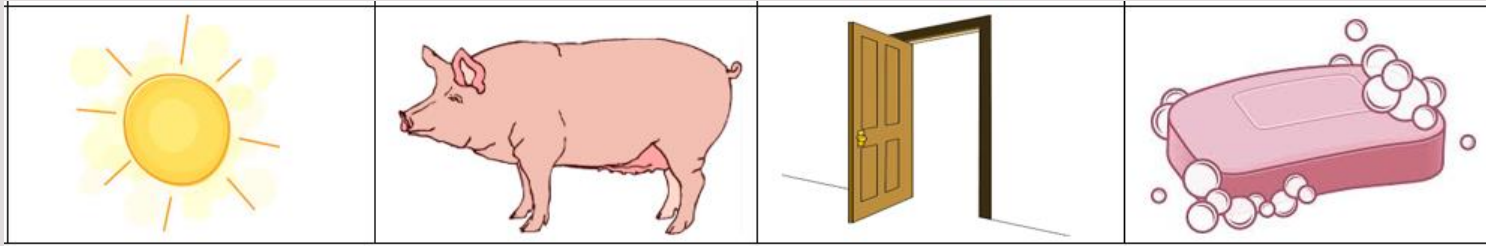
- The development of PA depends on the phonological structure of a language.
- isiXhosa, isiZulu and Northern Sotho have open syllable structures (vowel / consonant-vowel) – this means that syllables are very salient phonological units in these languages
 - sounds are typically introduced to learners as syllables (*ba, bi, bo, be, bu*)
- All three languages have transparent orthographies (there is a consistent mapping between phonemes and graphemes), but isiXhosa and isiZulu readers learn more phonic patterns because of larger consonant inventories.

Phonological awareness measures

SOUND MATCHING



Which word **starts** with the same sound as **foot**? *Bat, hook, or fish?*



Ke lentšu lefe leo le thomago ka modumo wa go swana le **letšatši**? *Kolobe, lebati le sesepe?*

SOUND ISOLATION

The word **man** has three sounds, **/m/ - /a/ - /n/**, **man**. What is the first sound, the one in the beginning, in the word **man**?

Igama elithi **ipali** linezandi ezintlanu kulo. **/i/ - /p/ - /a/ - /l/ - /i/**. Sesiphi isandi sesibini sokuthi **ipali**?

BLENDING

- What word do these sounds make? *pen-səl* | pencil
- Na medumo ye e bopa lentšu lefe? *le-bo-ne* | lebone

SOUND ELISION

- Syllable level and phoneme level:
 - Say *spider*. Now say *spider* again without saying *der* | spi
 - Say *meet*. Now say *meet* without saying */t/* | me
- Bolela lentšu le *Batswadi* Bjale le boeletše, efela she bolele */di/* | batswa

Phonological working memory (PWM) and reading

- PWM is the coding of sound-based representations of spoken (or written) information, which facilitates the **temporary storage** of such information in working memory.
- PWM is linked to reading achievement; it plays a critical role when letter-sound correspondences are acquired.
- PWM system can also preserve strings of phonological information (i.e. **words, phrases or sentences**) for brief periods, which enables a reader to comprehend longer units of text.

PWM Measures

DIGIT SPAN

Item	Digits	Response	Score (1 or 0)
5.	1 6	_____	<input type="checkbox"/>
6.	7 2	_____	<input type="checkbox"/>
7.	9 4	_____	<input type="checkbox"/>
8.	5 2 1	_____	<input type="checkbox"/>
9.	6 4 8	_____	<input type="checkbox"/>
10.	8 3 6	_____	<input type="checkbox"/>
11.	5 3 1 8	_____	<input type="checkbox"/>
12.	3 7 4 1.....	_____	<input type="checkbox"/>
13.	7 5 9 6	_____	<input type="checkbox"/>
14.	4 1 8 3 9 ...	_____	<input type="checkbox"/>
15.	6 3 2 5 8 ..	_____	<input type="checkbox"/>

NONWORD REPETITION

Nonwords are words that has no meaning, and is not known to exist in a language, but they follow the phonological rules of the language (so they *could have been* words).

ENGLISH	NORTHERN SOTHO	ISIXHOSA/ ISIZULU
Teeg	Miša	Baluki
Nigong	Tšhupeng	Lutsibadu
Chaseedoolid	Hlatôyani	Zatilayishi

Rapid automatised naming (RAN) and reading

- RAN is the ability to quickly name a series of visually presented familiar symbols.
- Two types: alphanumeric RAN (i.e. letter- and digit naming) and non-alphanumeric RAN (i.e. object- and colour naming).
- RAN is a reliable index of automaticity in word reading processes, and is also a good predictor of fluent reading processes.

RAN measures

4

2	7	4	5	3	8	4	2	5
8	3	7	2	8	4	3	5	7
4	8	2	7	5	3	5	2	8
3	4	7	3	2	5	8	7	4

Rapid Digit Naming

a

s t n a k c t s c

k a n c k t a n s

t k c s n a t c n

k a s n c k s t a

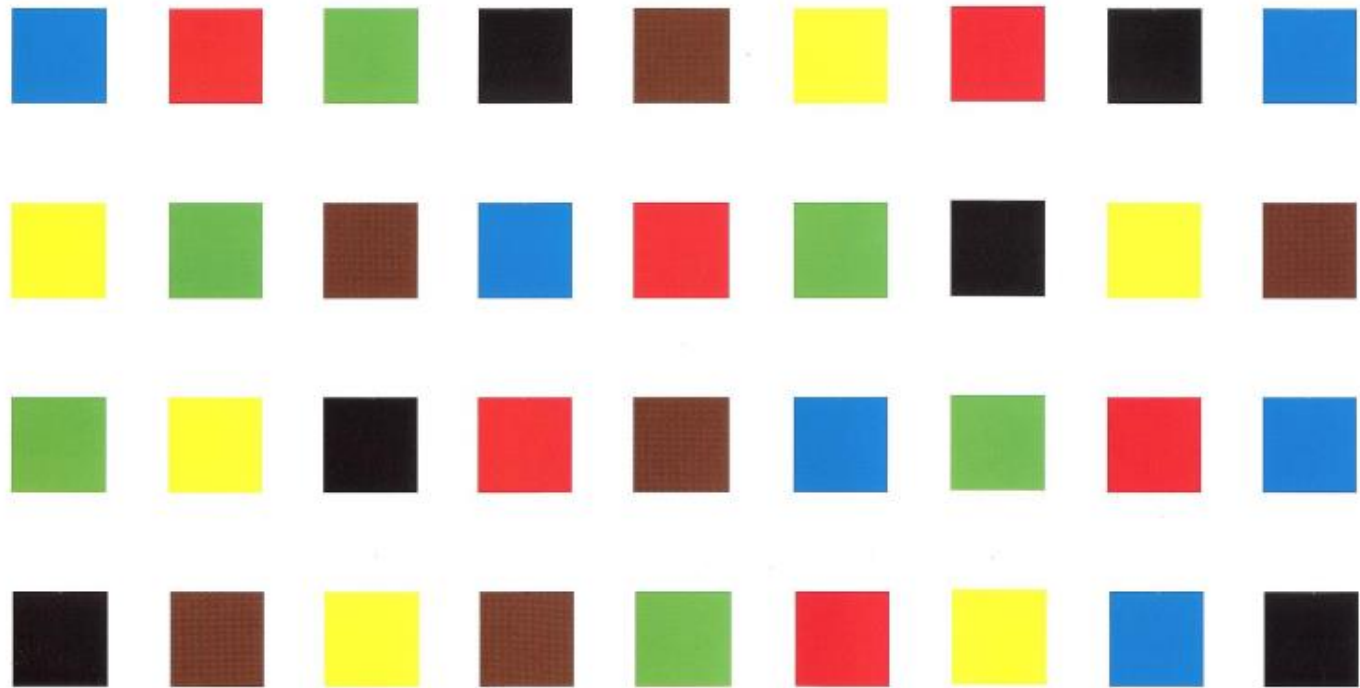
Rapid letter naming

Rapid Letter Naming



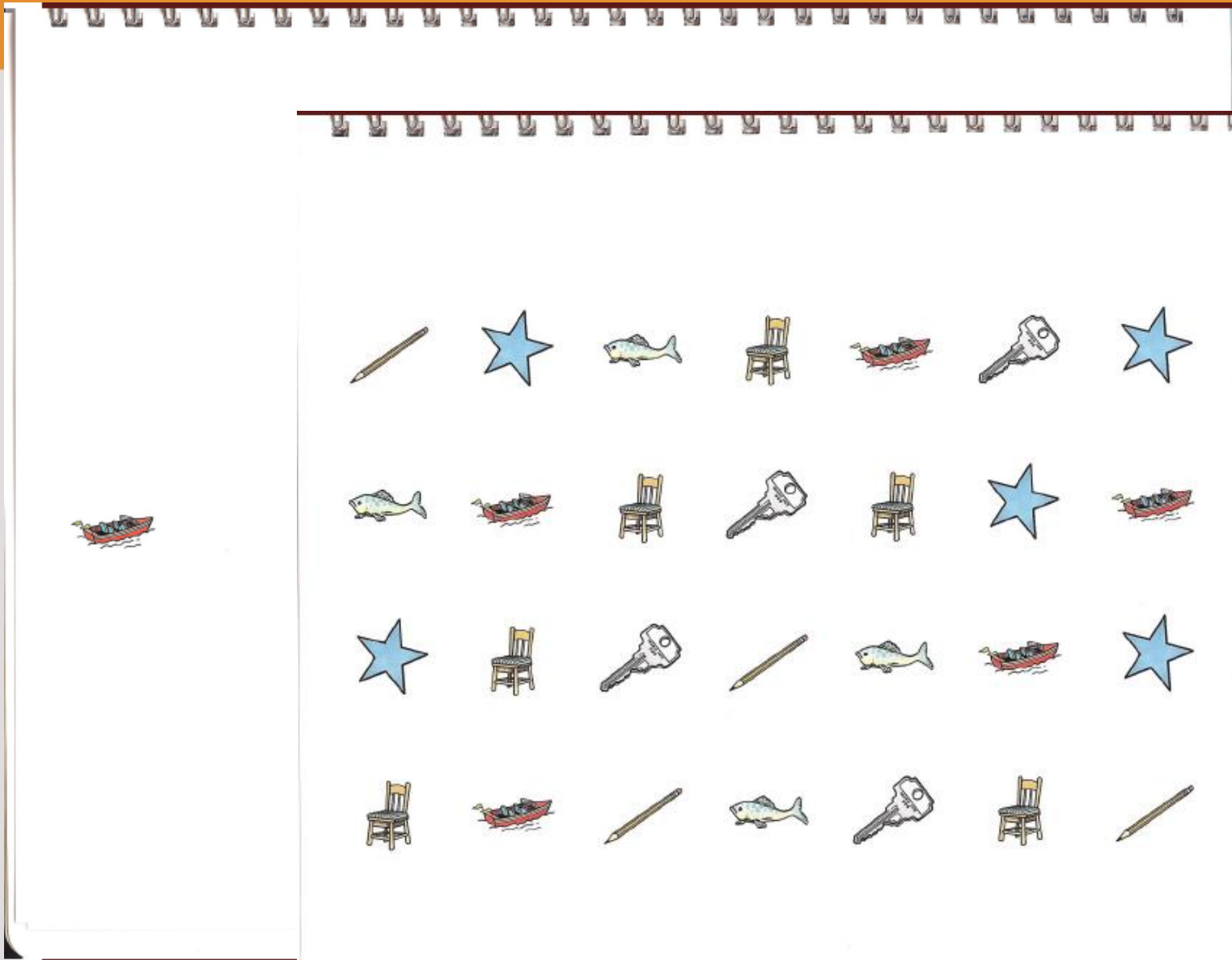
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Rapid colour naming



Rapid Color Naming

Rapid object naming



Rapid Object Naming

Letter-sound correspondence knowledge

Chart 3 LETTER SOUNDS

Isibonelo:

b	s	f	hl
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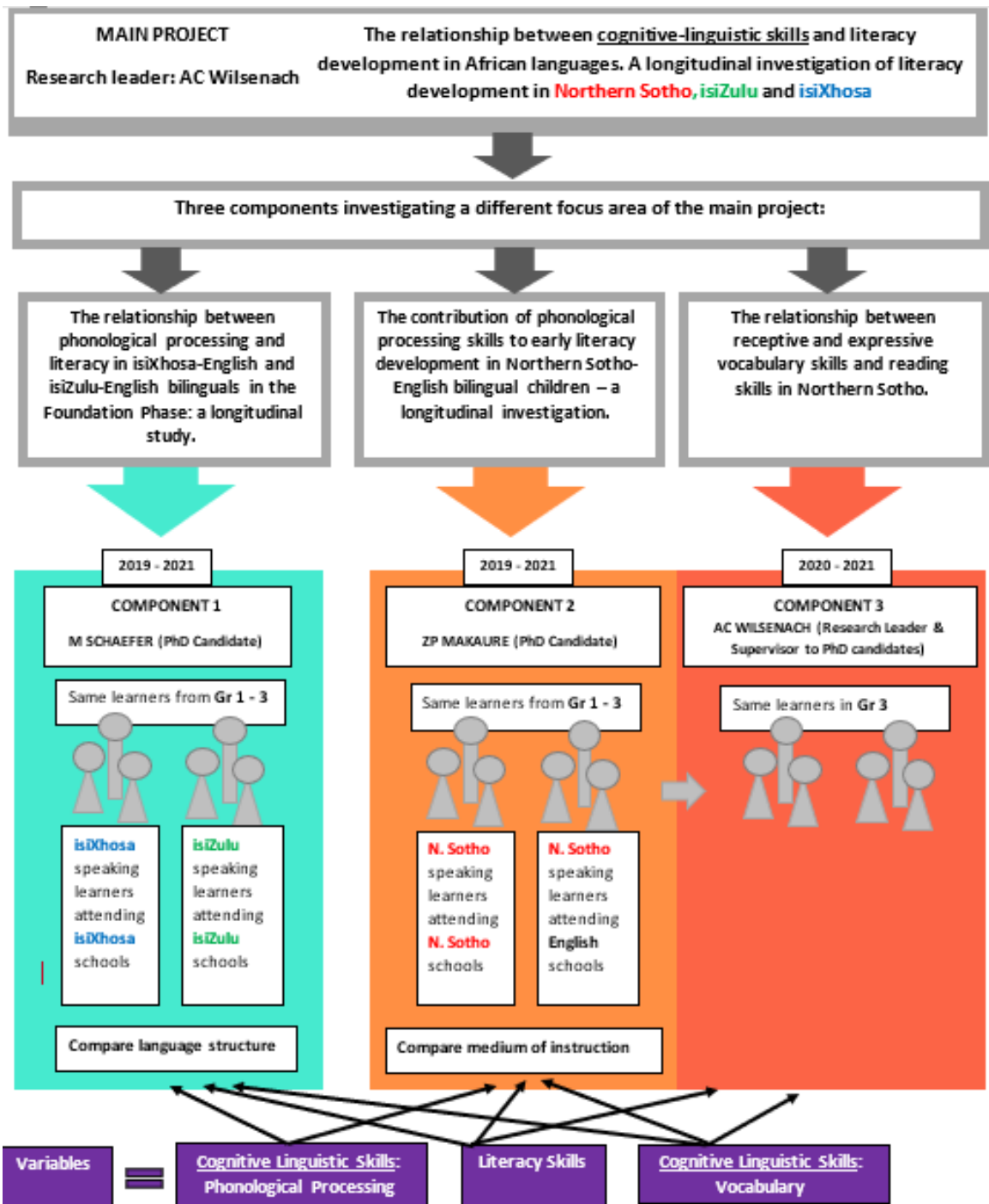
m	l	h	g	S	y	Z	W	p	n
L	th	T	c	b	a	hl	o	n	ng
i	b	th	M	U	sh	j	dl	K	u
g	R	B	kh	l	f	hl	M	s	kw
S	N	ph	B	p	v	k	a	E	D
R	A	t	P	f	sh	h	u	a	t
dw	G	H	B	S	l	g	m	i	j
B	dl	o	m	O	Y	E	N	p	t
g	K	B	ny	y	bh	Z	V	D	nc
f	s	ng	a	z	p	C	th	G	sw
V	ncw	q	h	nhl	g	sh	y	kh	t

- Learner is presented with a card containing letter sounds; learner has to read the sounds from left to right.
- Score = number of correct sounds read in 1 minute

- In research that approach reading from a psycholinguistic perspective, the main aim in assessing PA, PWM and RAN is to establish to what extent these variables are associated with, and predict, literacy outcomes (such as letter reading, word reading, fluent reading, reading comprehension and spelling).
- In the last decade, there has been growing interest in South Africa on the role of PP skills in reading development in African languages, and these studies all report significant associations between PP and reading outcomes.
 - isiZulu: Land, (2015b, 2015a, 2016); Schaefer & Kotzé, (2019)
 - isiXhosa: Daries, (2021); Daries & Probert, (2020); Diemer et al., (2015); Schaefer et al., (2020)
 - Siswati: Schaefer & Kotzé, (2019)
 - isiNdebele: Sithole, (2018).
 - Northern Sotho: Makaure, (2016, 2021); Wilsenach, (2013, 2019, 2020); Wilsenach & Makaure, 2018)
 - Setswana: Lekgoko & Winskel, (2008); Malda et al., (2014); Probert, (2019)
 - SeSotho: Probert, (2019).
 - Xitsonga: Khosa, (2021).

Research gap

- The existing research in South Africa is:
 - predominantly cross-sectional
 - based on third graders
 - did not examine PP skills and literacy outcomes in-depth, and not in both the languages that children know (except for Makaure (2016, 2021)).
- Thus, we don't know to what extent PP skills measured in Grade 1 predict later reading outcomes, and very little is known about developmental trajectories of PP skills.



Research design

- Longitudinal quantitative design*

	NORTHERN SOTHO	ISIZULU	ISIXHOSA
GRADE 1 TERM 3	-	X PP; LSF; WR; ORF; EW	X PP; LSF; WR; ORF; EW
GRADE 2 TERM 1	X PP; LSF; WR; ORF; EW	-	-
GRADE 2 TERM 3	X PP; LSF; WR; ORF; EW	-	-
GRADE 3 TERM 1	-	X PP; LSF; WR; ORF; EW	X PP; LSF; WR; ORF; EW
GRADE 3 TERM 3	X RC; SP	X WR; ORF; RC; SP	X WR; ORF; RC; SP

KEY

PP: Phonological processing (PA, PWM, RAN)

LSF: Letter sound fluency

WR: word reading

ORF: oral reading fluency

EW: Early writing

RC: Reading comprehension

SP: Spelling

NOTE: We also measured vocabulary skills once for every child, as a control variable.

Setting and Participants

Research conducted in 4 urban schools in Tshwane (Northern Sotho and isiZulu) and 2 semi-urban schools on outskirts of East London (isiXhosa)

	Northern Sotho	isiXhosa	isiZulu
National School Nutrition Programme	Yes	Yes	Yes
School quintile	2 & 3	2	2 & 3
Home Literacy Experience			
Parent never reads to the child (%)	-	54	36
Child never reads to the parent (%)	-	60	19
No children's books at home (%)	-	60	61
Number of languages understood by child	-	2	3
Number of languages spoken by child	-	1	2.3

Instruments phonological processing skills

CTOPP

(Wagner et al., 1999)

*Comprehensive Test of
Phonological Processing*

The standardised
version of the CTOPP
was used to assess
skills in English

Tasks measuring the
same constructs
(PA, PWM and RAN)
In Northern Sotho,
isiXhosa and isiZulu
were developed

PA

Sound isolation (Phoneme level)

Sound matching

Sound blending (Syllable | Phoneme)

Sound elision (Syllable | Phoneme)

PWM

Non word repetition

Digit span forward task

RAN

Digits, letters, colours, objects

Literacy measures

- Word reading (word recognition)
- Fluent reading (oral reading fluency (ORF))
- Reading comprehension
- Early writing
- Spelling

English Word reading

Regular word reading sub-test from Diagnostic Test of Word Reading Processes

up	sun	them	went	us
made	dragon	well	mouse	gave

elephant	street	corner	kettle	noise
ostrich	chimpanzee	picnic	perhaps	goblin

banister	statue	marzipan	experimental	turmoil
concentrate	sacrifice	wilderness	auditorium	anecdote

Home Language Word reading

Northern Sotho
eta
nne
kga
gae
ntlo
efa
seo
bona
pitsi
rena
motho
bina
hlapa
fela
maswi
batswadi
thapelo
bošego
lebala
meetse

isiZulu	isiXhosa
ya	ya
abo	abo
into	into
lala	lala
beka	beka
igama	igama
amanzi	amanzi
imoto	imoto
phuma	phuma
funa	funa
vula	vula
mela	mela
usana	usana
unyawo	unyawo
wela	wela
thwala	thwala
uthuli	uthuli
intombazane	intombazana
ufudu	ufudo
usiba	usiba
vusa	vusa
uzipho	uzipho
umlenze	umlenze
imali	imali
ilanga	ilanga
isandla	isandla
ikati	ikati
indoda	indoda

Oral Reading Fluency

- Oral reading fluency assessed with a 1-minute test in both the Home Language and in English.
- Score = total number of words read per minute – errors = words read correctly in a minute.

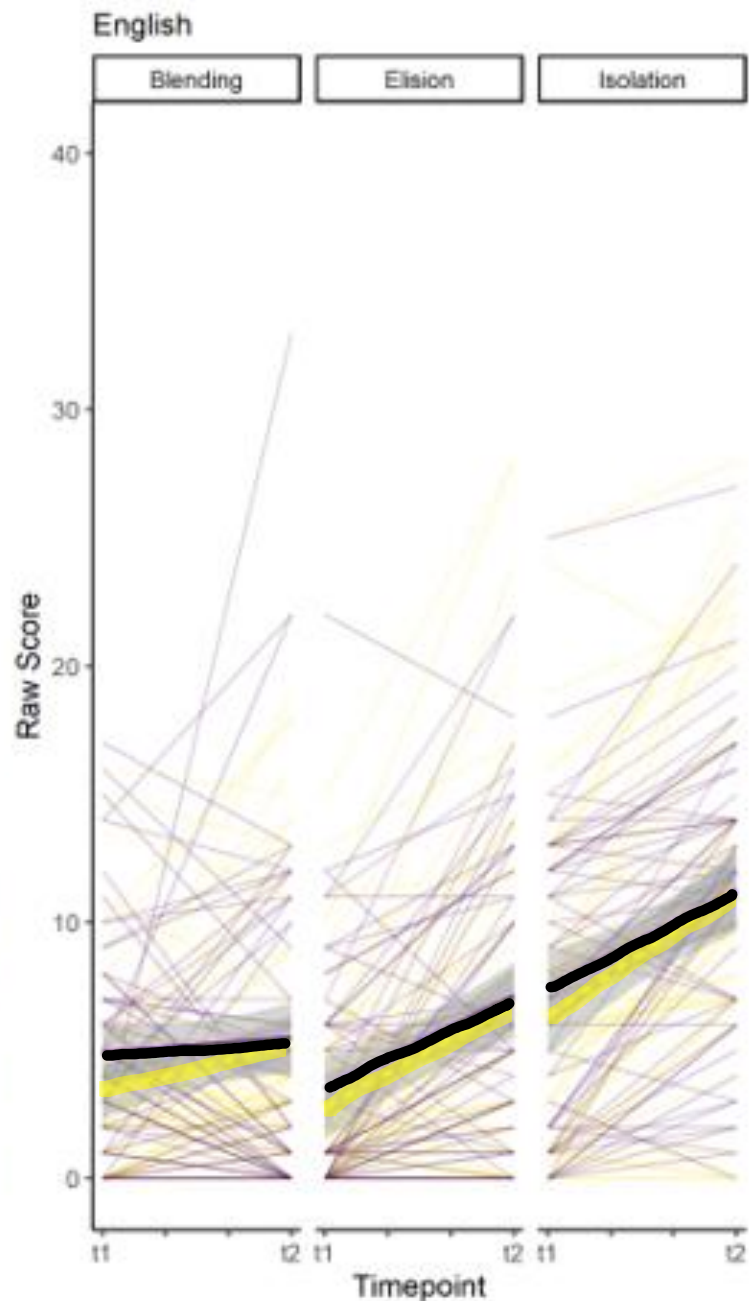
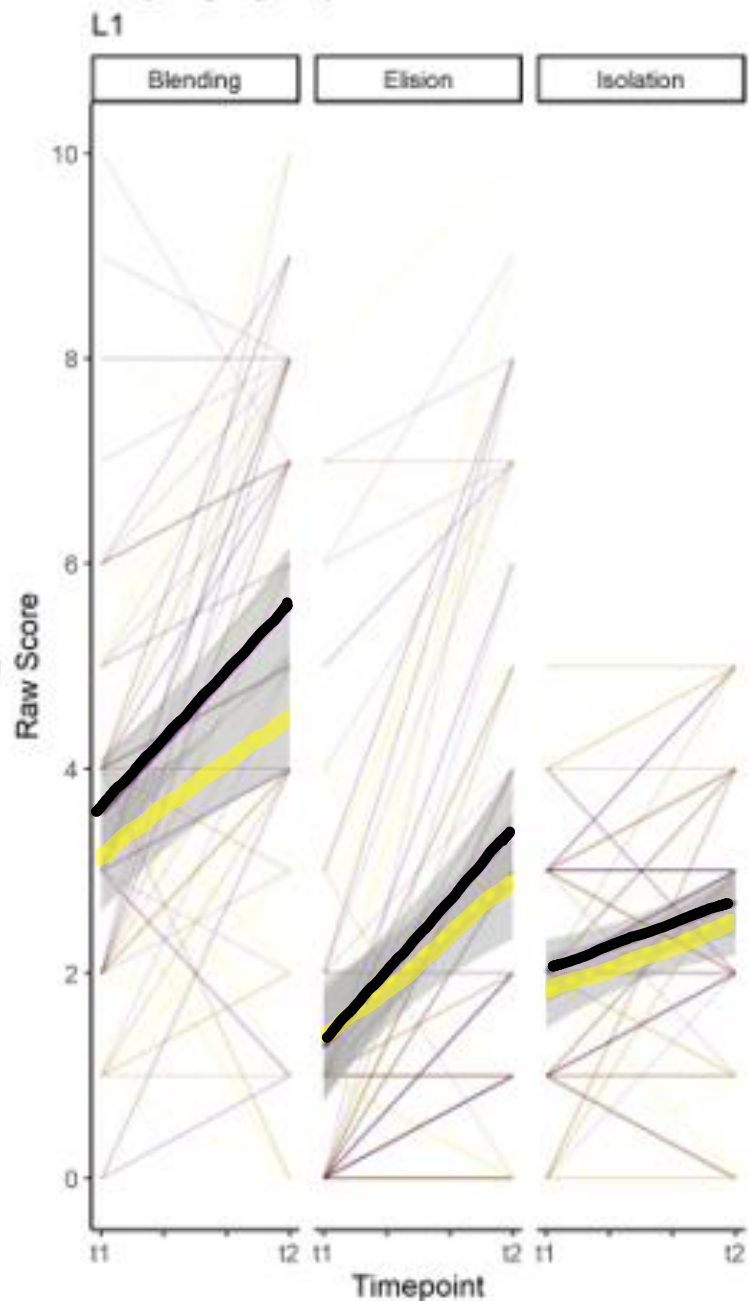
Reading comprehension

- Silent reading of grade appropriate text, followed by questions. Children had to answer questions individually in writing.

	Northern Sotho	isiXhosa	isiZulu	English
Number of words in text	161	149	140	124 (N Sotho) 57 (Nguni group)
Number of questions	6	6	6	6 (N Sotho) 4 (Nguni group)

Spelling

- Spelling was assessed in the HL and in English with a 10-item test, that increased in difficulty.

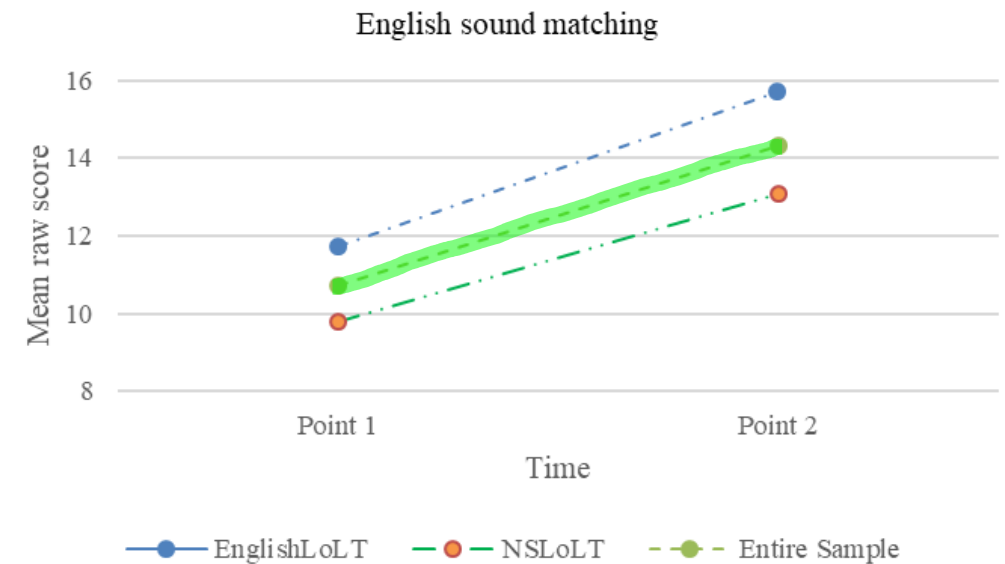
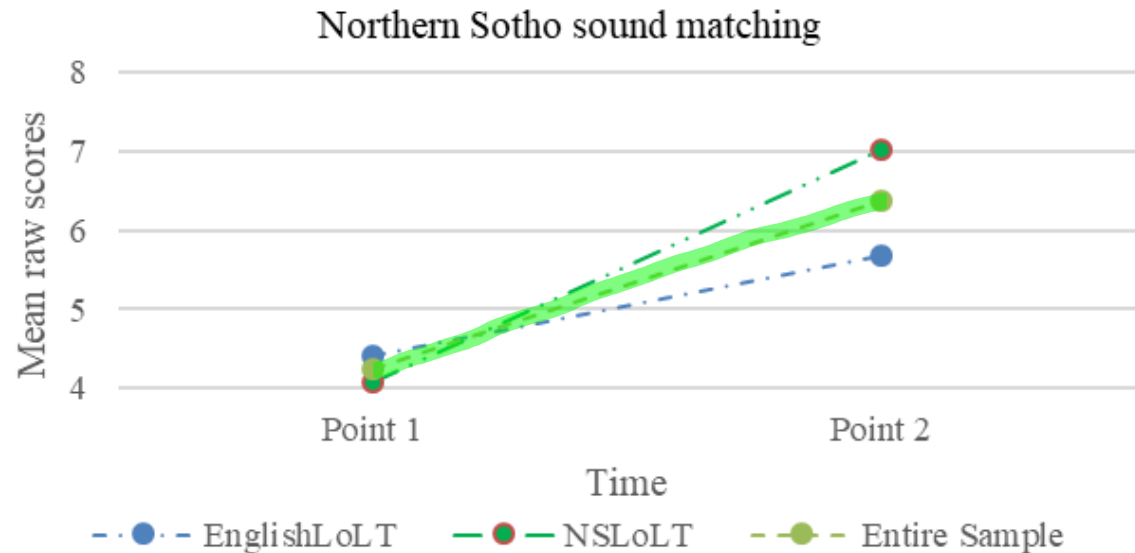
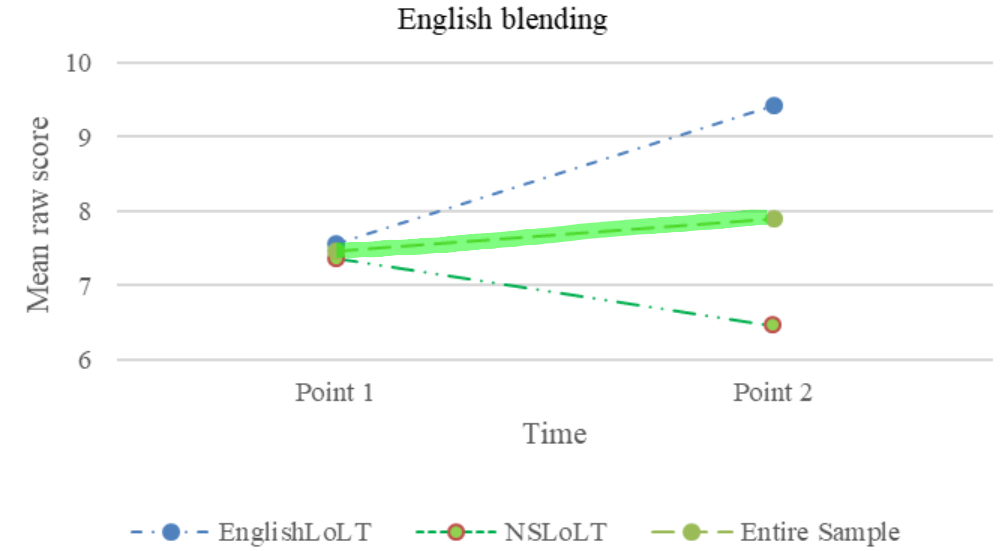
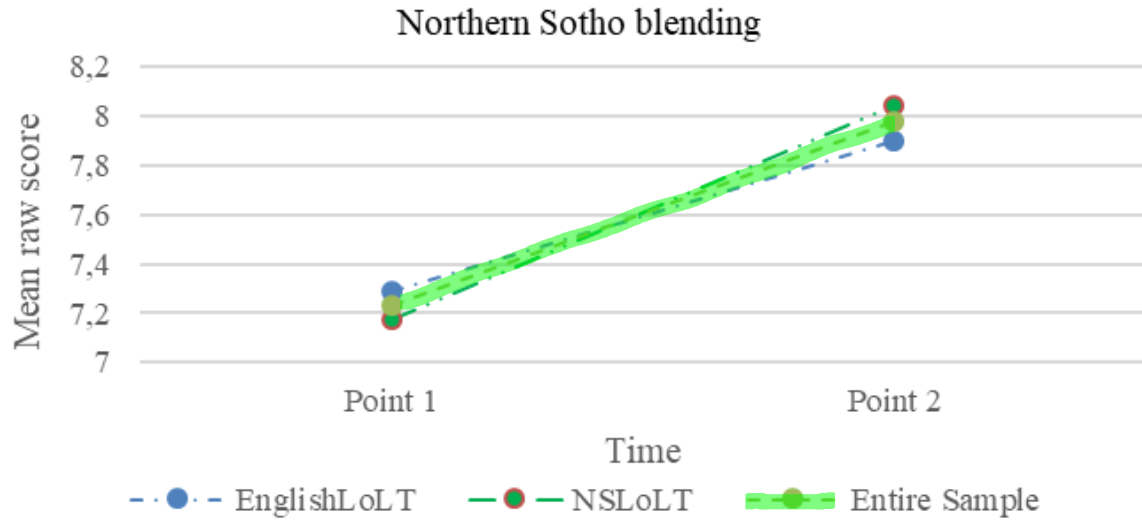


Development of phonological awareness skills: isiXhosa and isiZulu groups

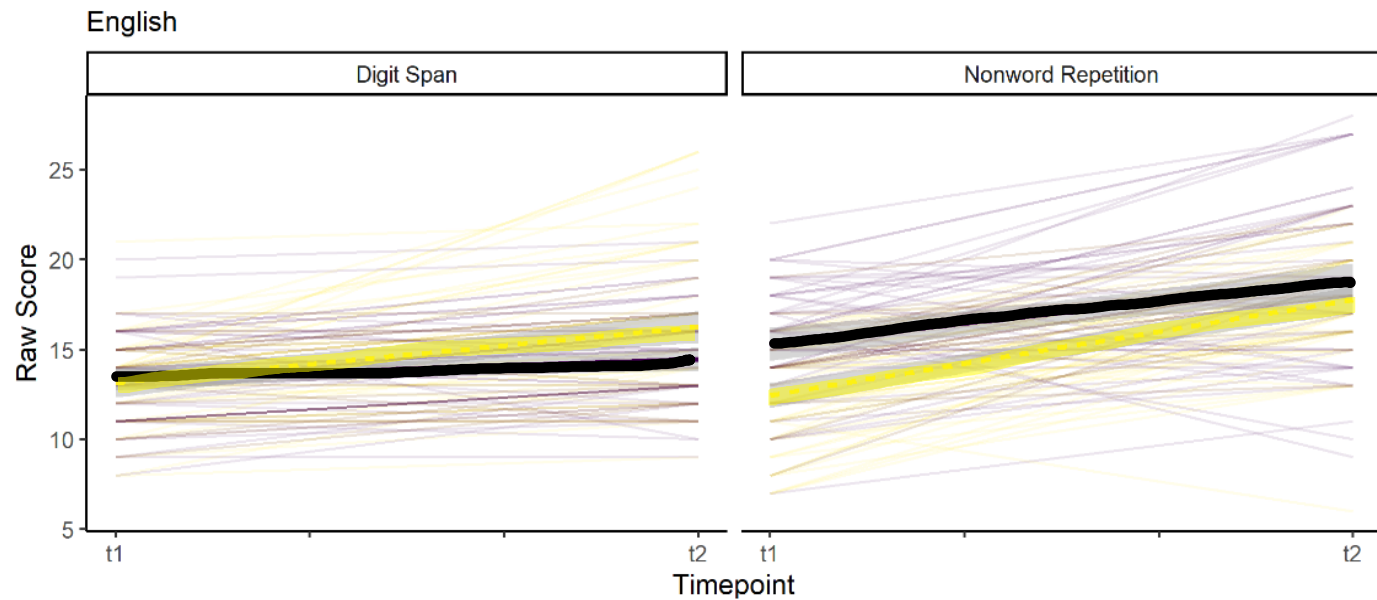
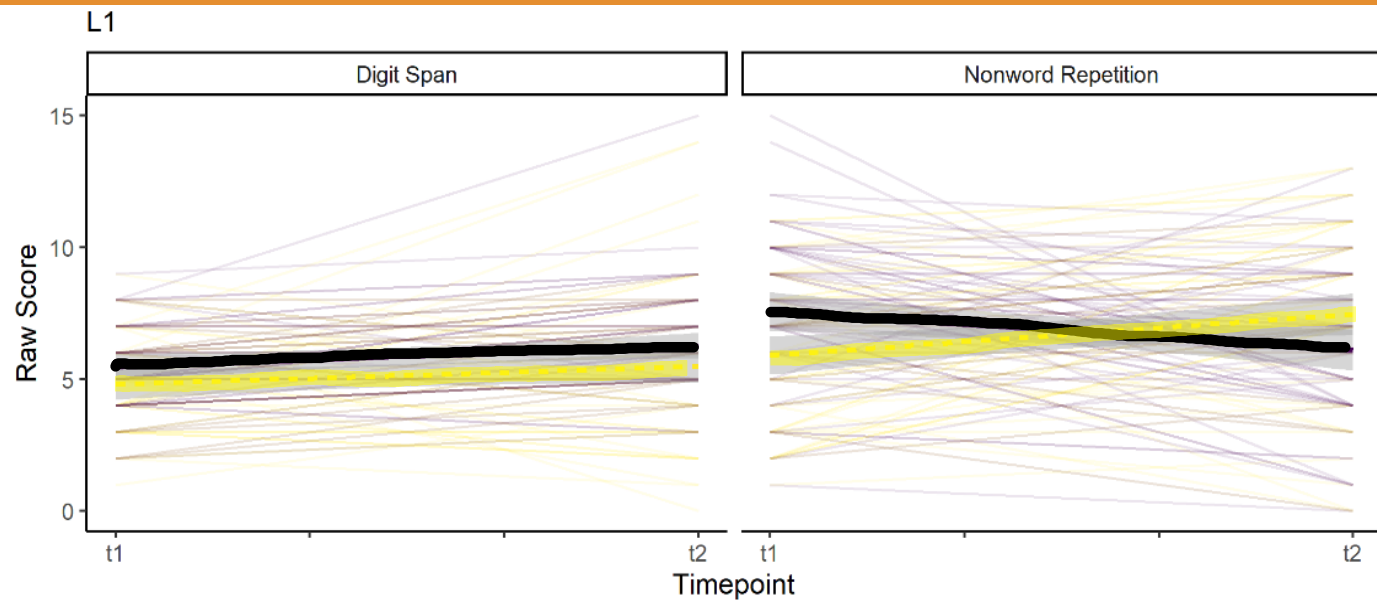
isiZulu

isiXhosa

Development of phonological awareness skills: Northern Sotho group

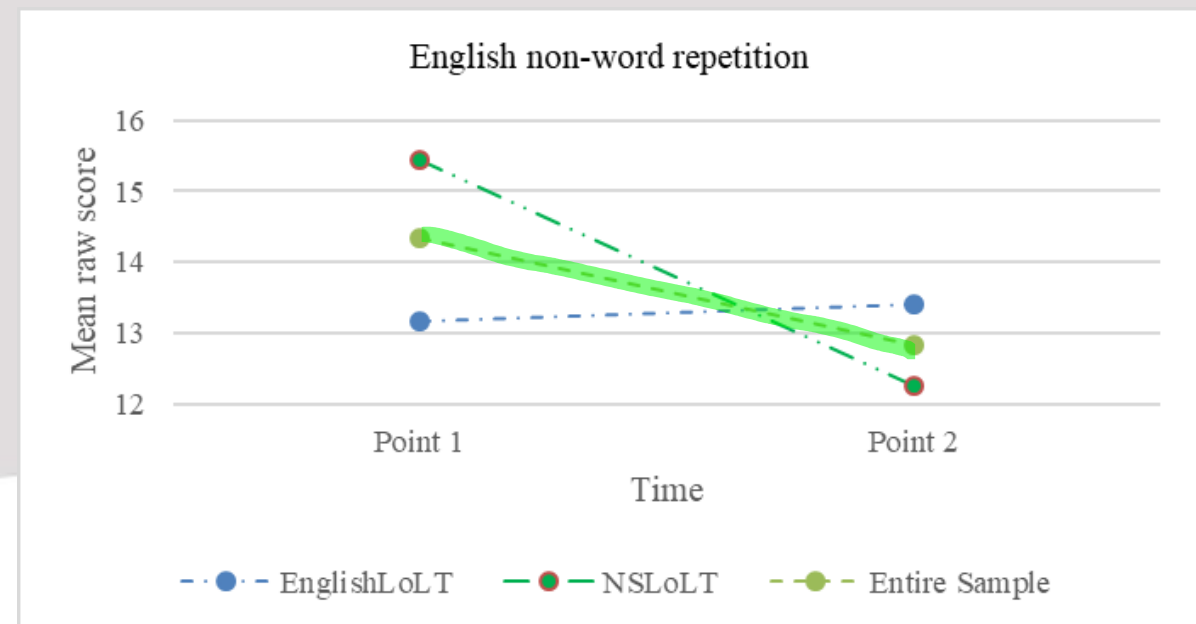
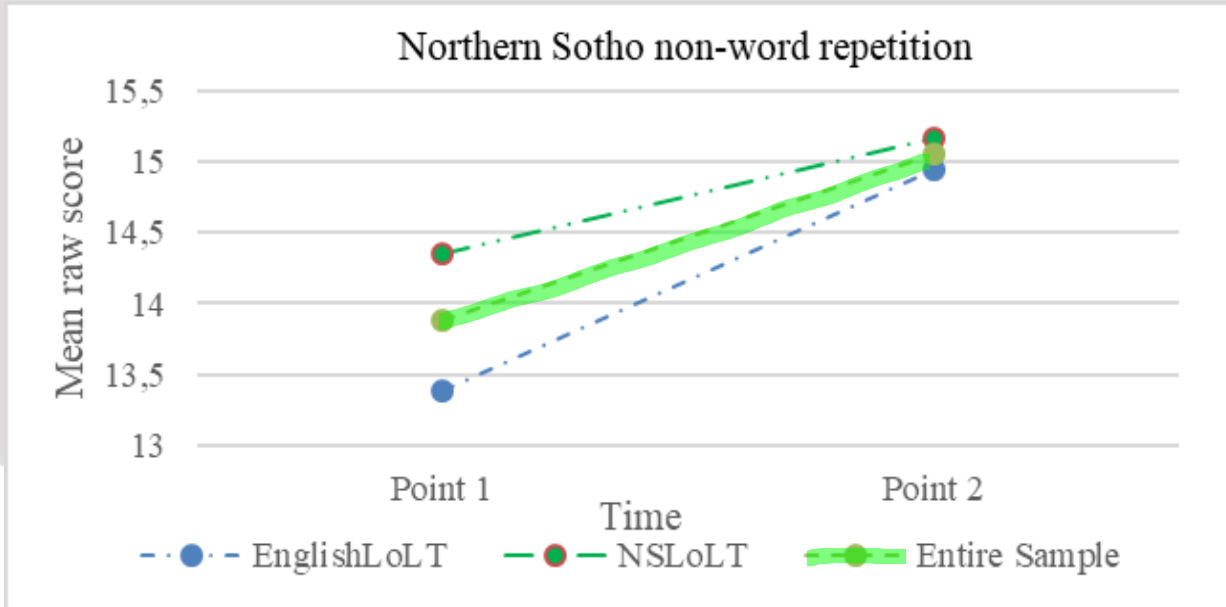
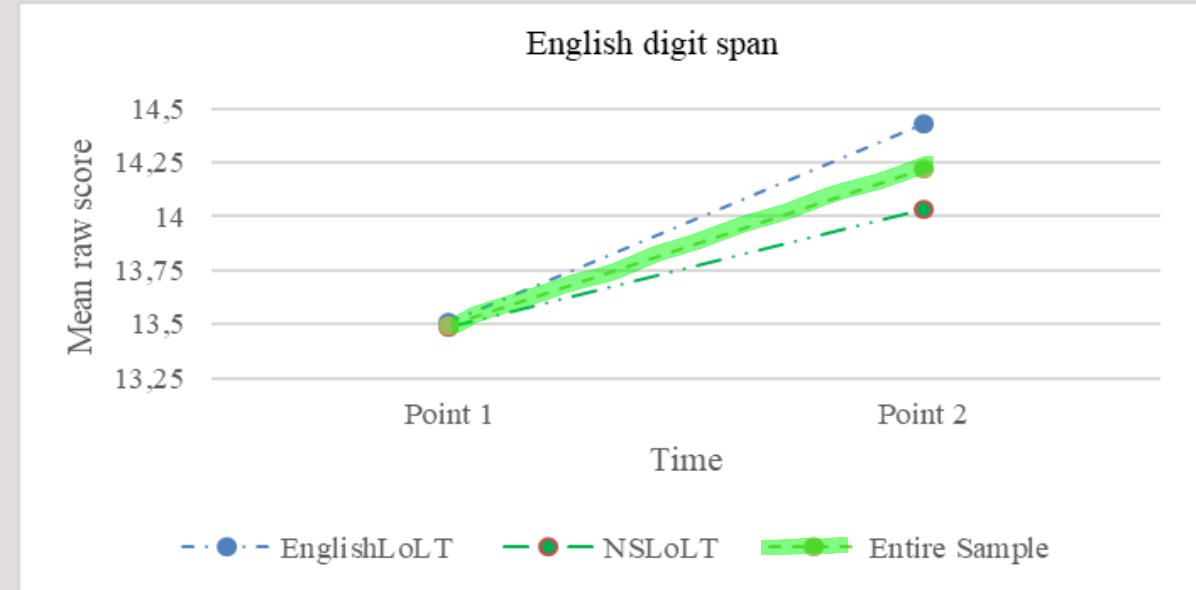
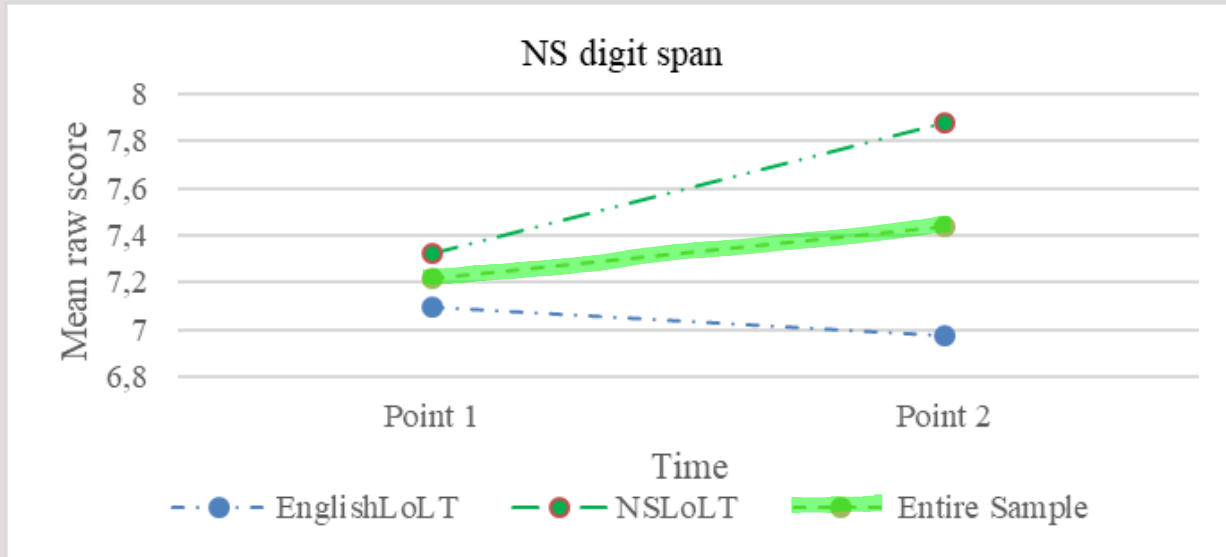


Development of phonological working memory: isiXhosa and isiZulu group

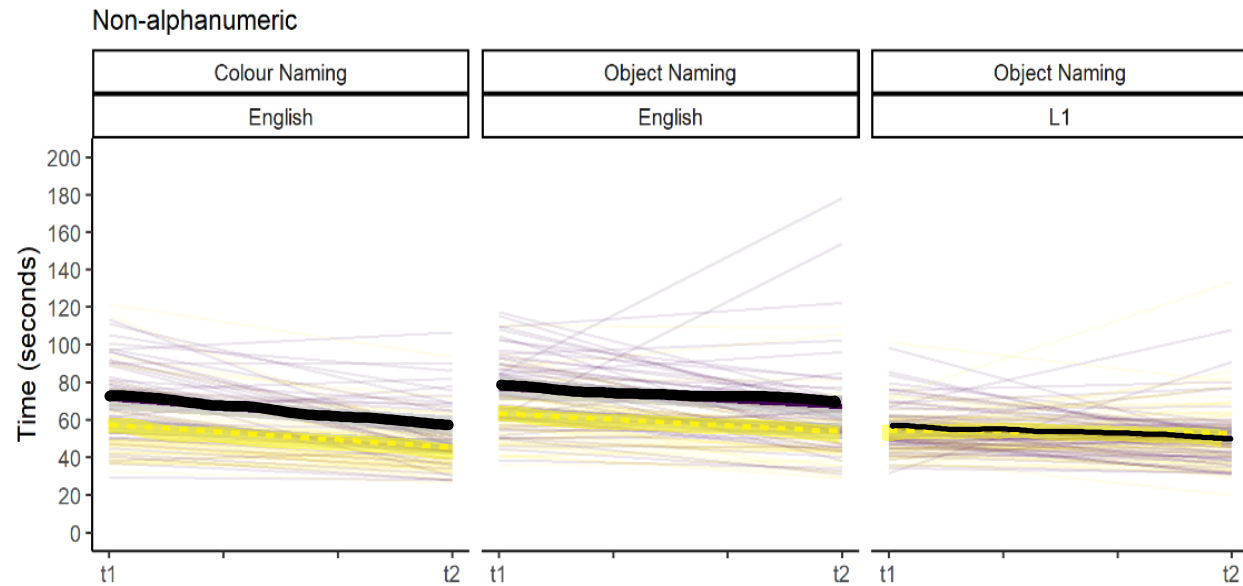
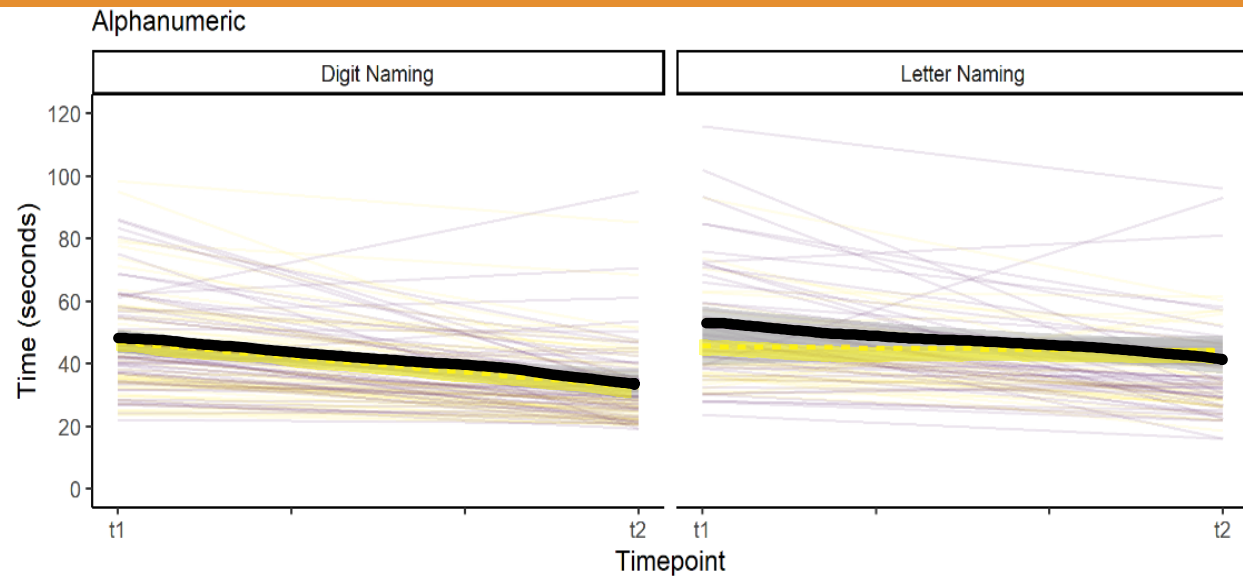


Language **isiZulu**
isiXhosa

Development of phonological working memory: Northern Sotho group



Development of automaticity (RAN): isiXhosa and isiZulu groups



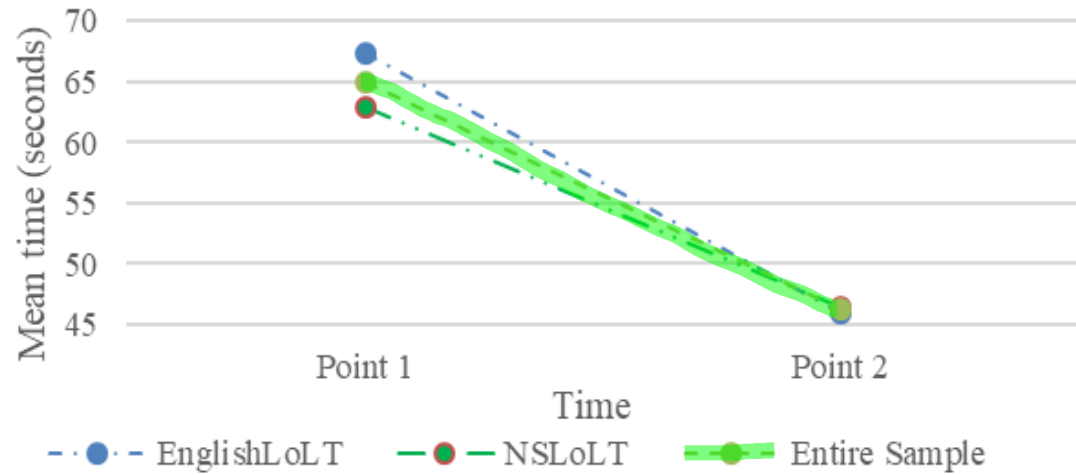
Language

isiZulu

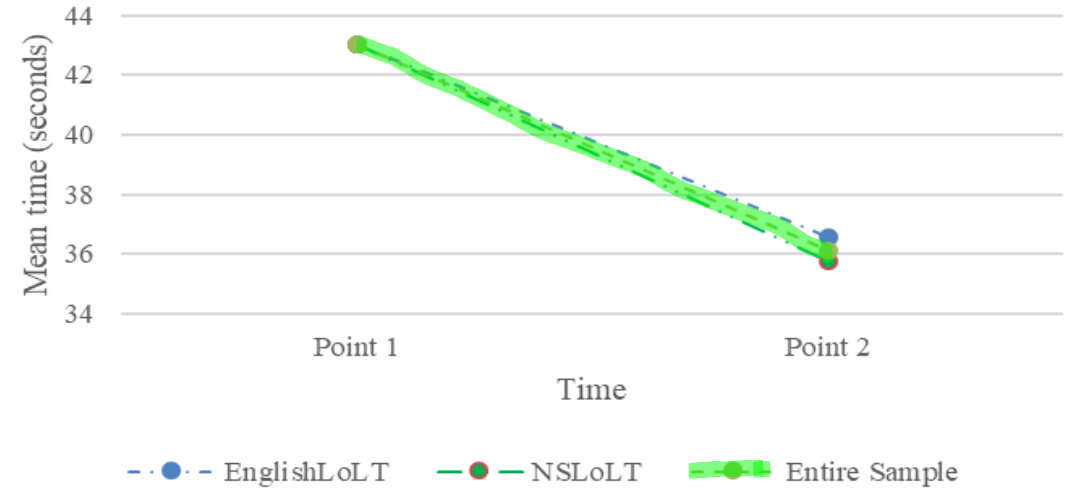
isiXhosa

Development of automaticity (RAN): Northern Sotho group

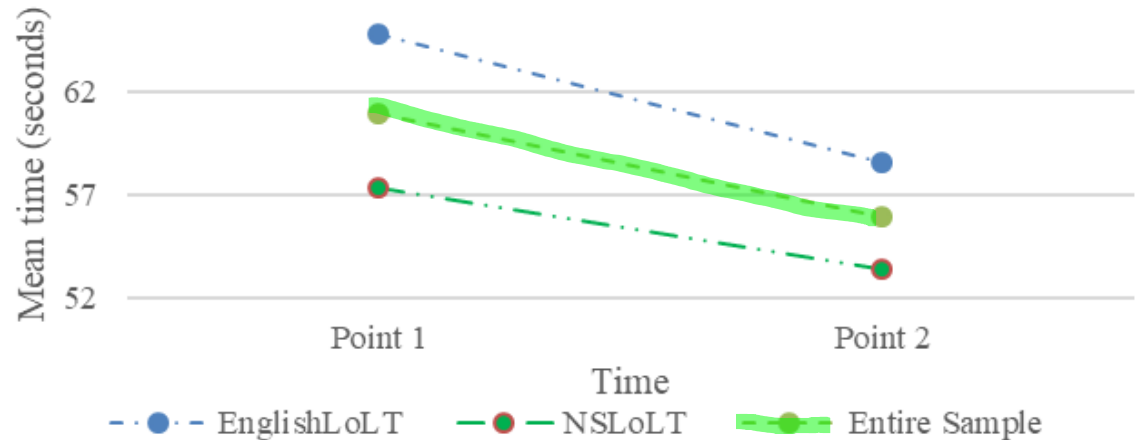
Northern Sotho RLN



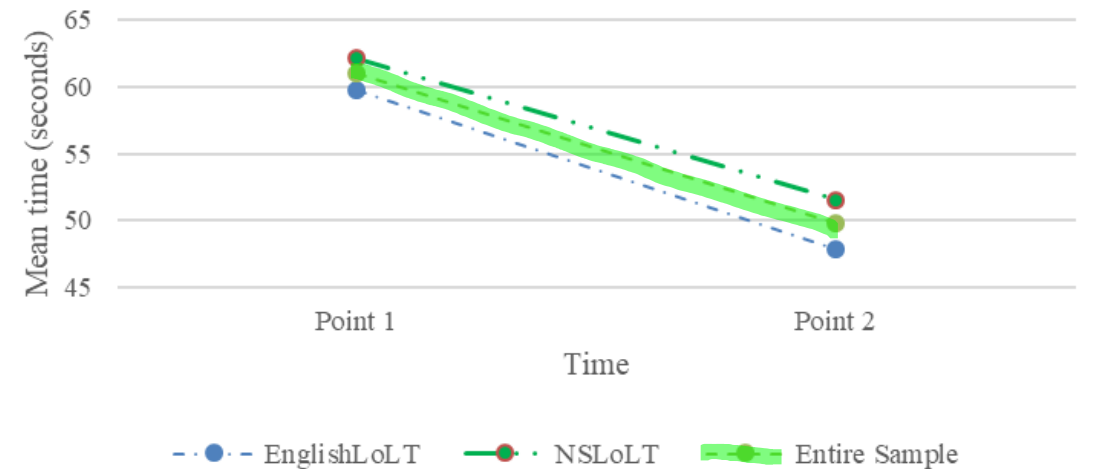
English RDN



Northern Sotho RON



English RON



Correlations between L1 PA and letter-sound fluency at time 2

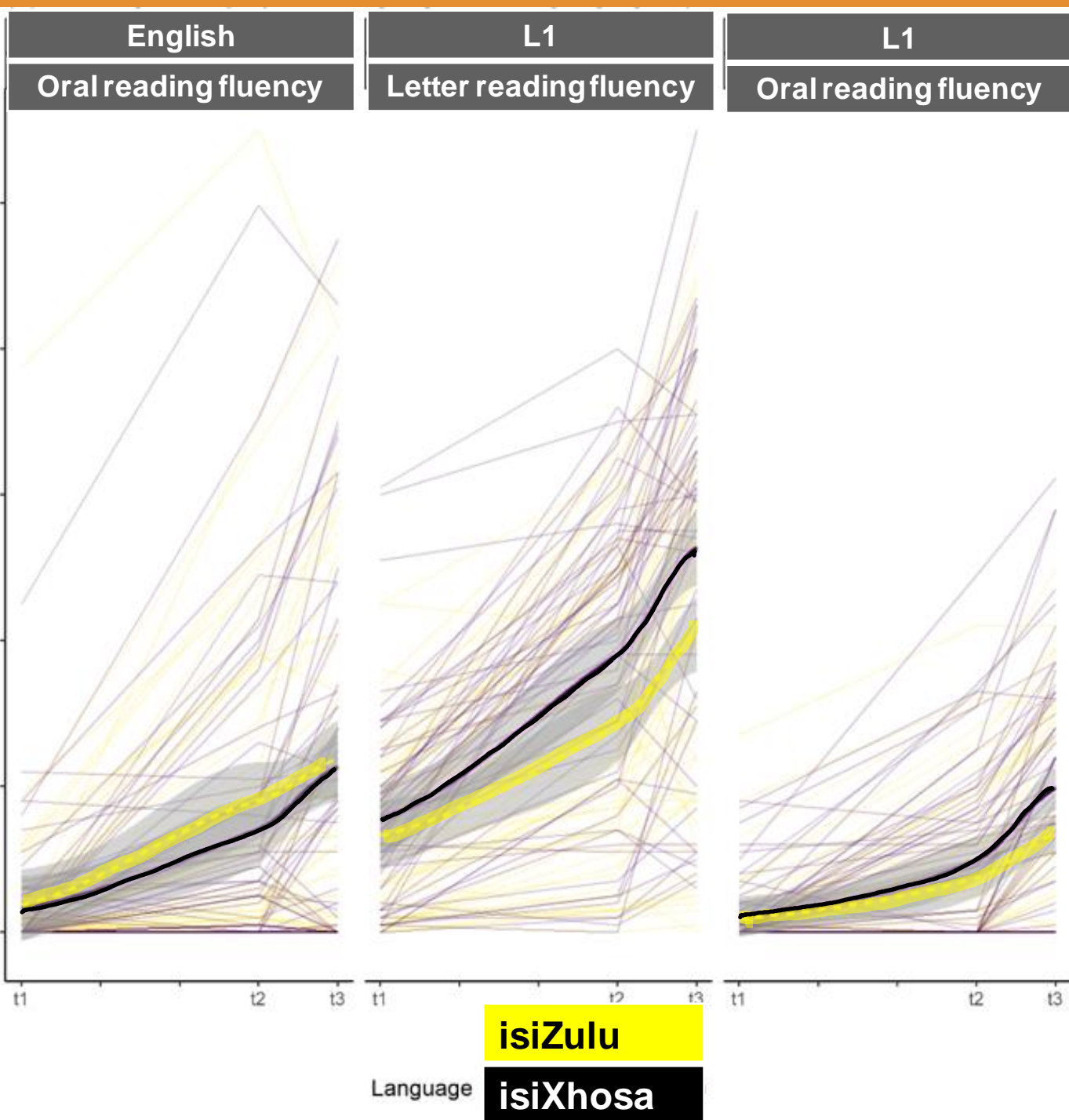
	isiXhosa LSF	isiZulu LSF	Northern Sotho LSF
ISOLATION	.56***	.72***	-
MATCHING	-	-	.48**
BLENDING	.55***	.70***	.46**
ELISION	.58***	.74***	.50**

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

- L1 phonological awareness skills are significantly and positively correlated to letter-sound fluency (knowledge of letter-sound correspondences).
 - These correlations are moderate to strong, depending on the task and the group.
- Better PA = Better letter-sound knowledge

Summary of developmental trajectory: PP skills

- Children showed significant growth from time 1 to time 2, in all three domains of phonological processing (PA, PWM and RAN), in both their HL and in English.
- The range of scores suggested that there is quite a lot of variation between children in terms of performance – some children already did quite well at time 1, whereas others scored 0. Children arrive with varying strengths in grade 1, even in their first language.



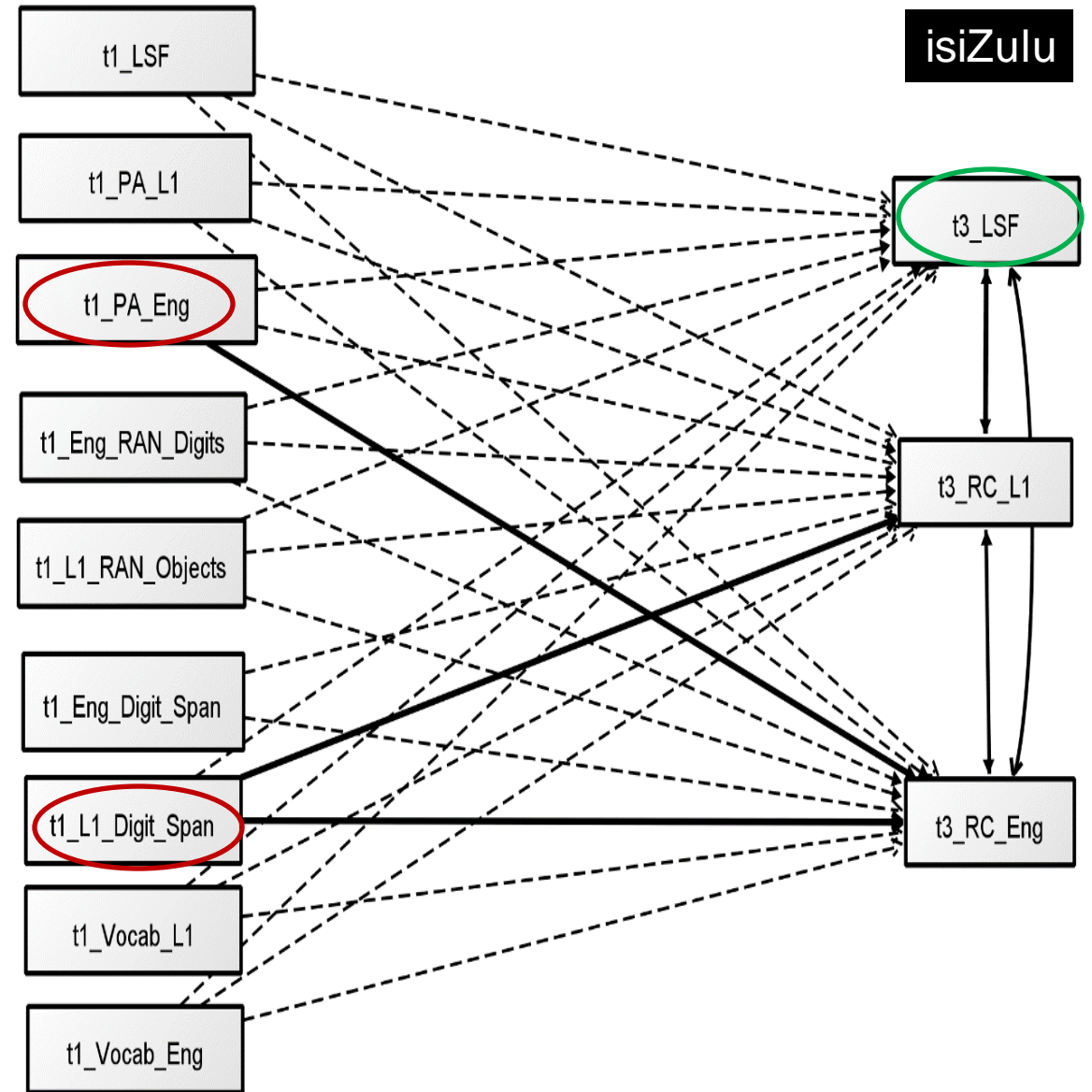
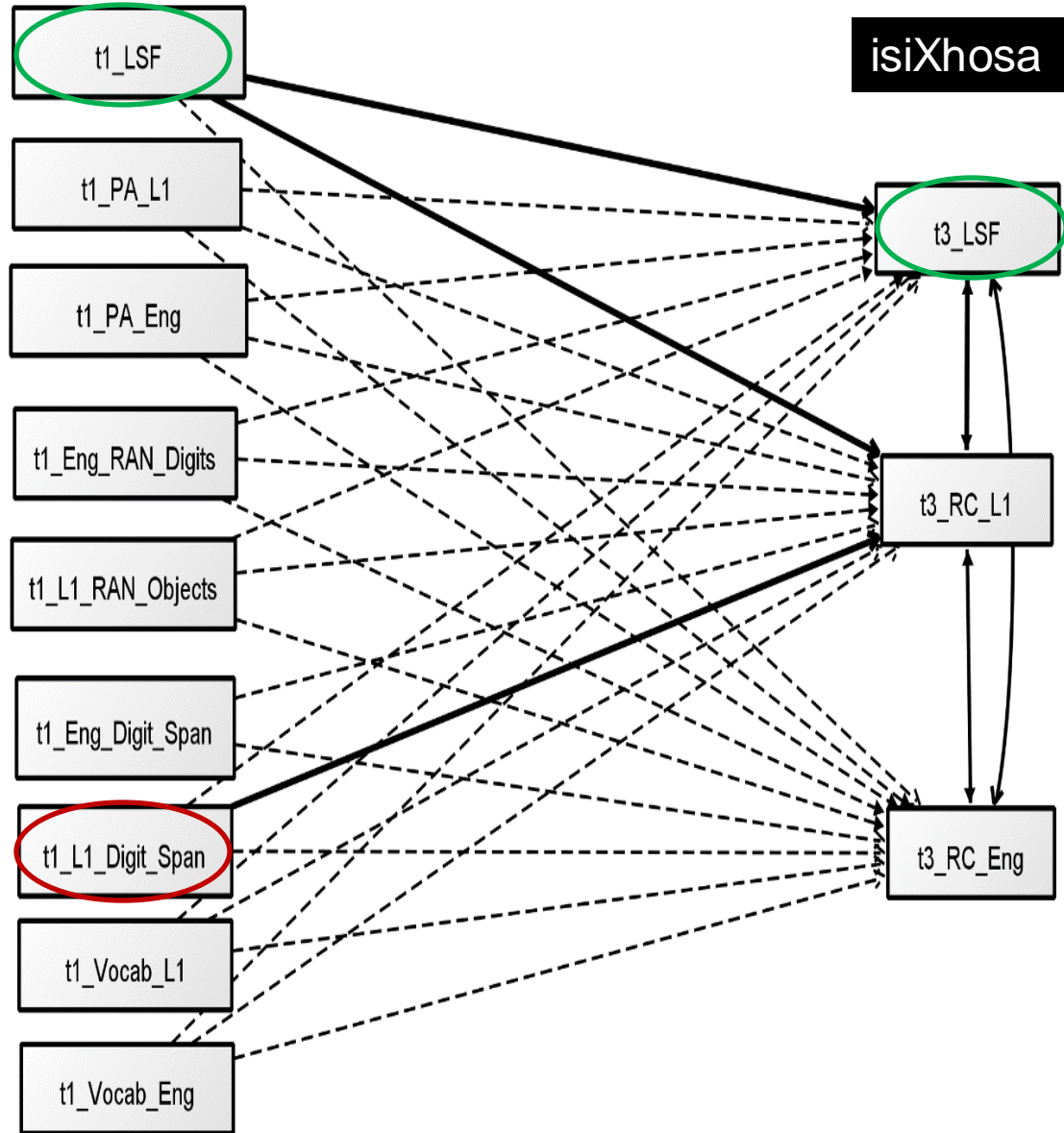
Development of reading

= slow growth from t1 to t2
changes to faster growth
between t2 and t3

L1 literacy end of Grade 3

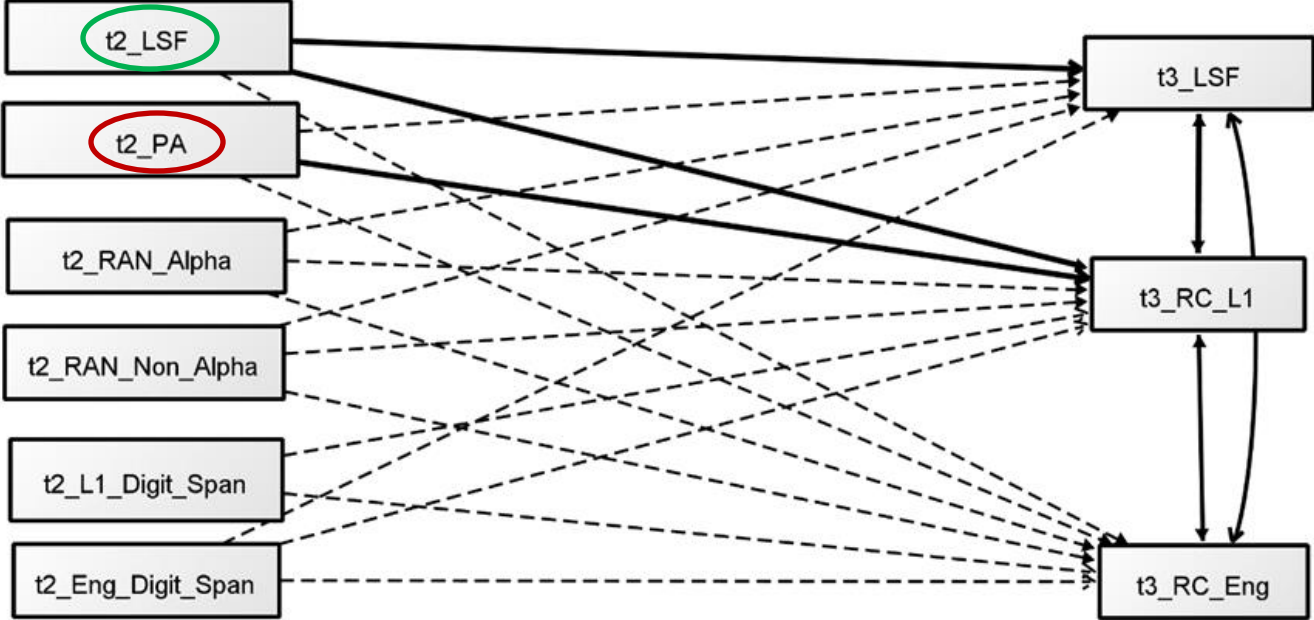
	isiXhosa	isiZulu
Zero LSF	0%	1.7%
Zero word reading	9.7%	32.2%
Zero ORF	21%	37.3%
Zero reading comprehension	23.3%	42.4%
Zero Spelling	13.3%	30.5%

Grade 1 predictors of reading comprehension (isiXhosa & isiZulu)

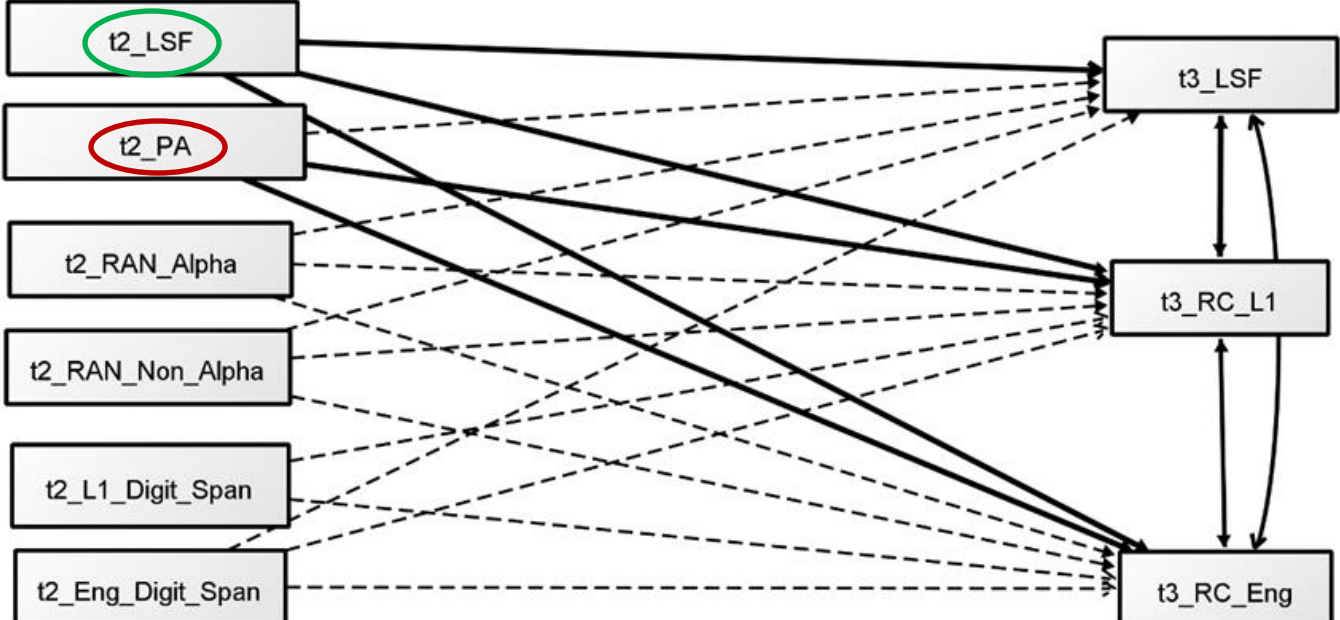


Grade 3 term 1
predictors of
reading
comprehension
isiXhosa & isiZulu

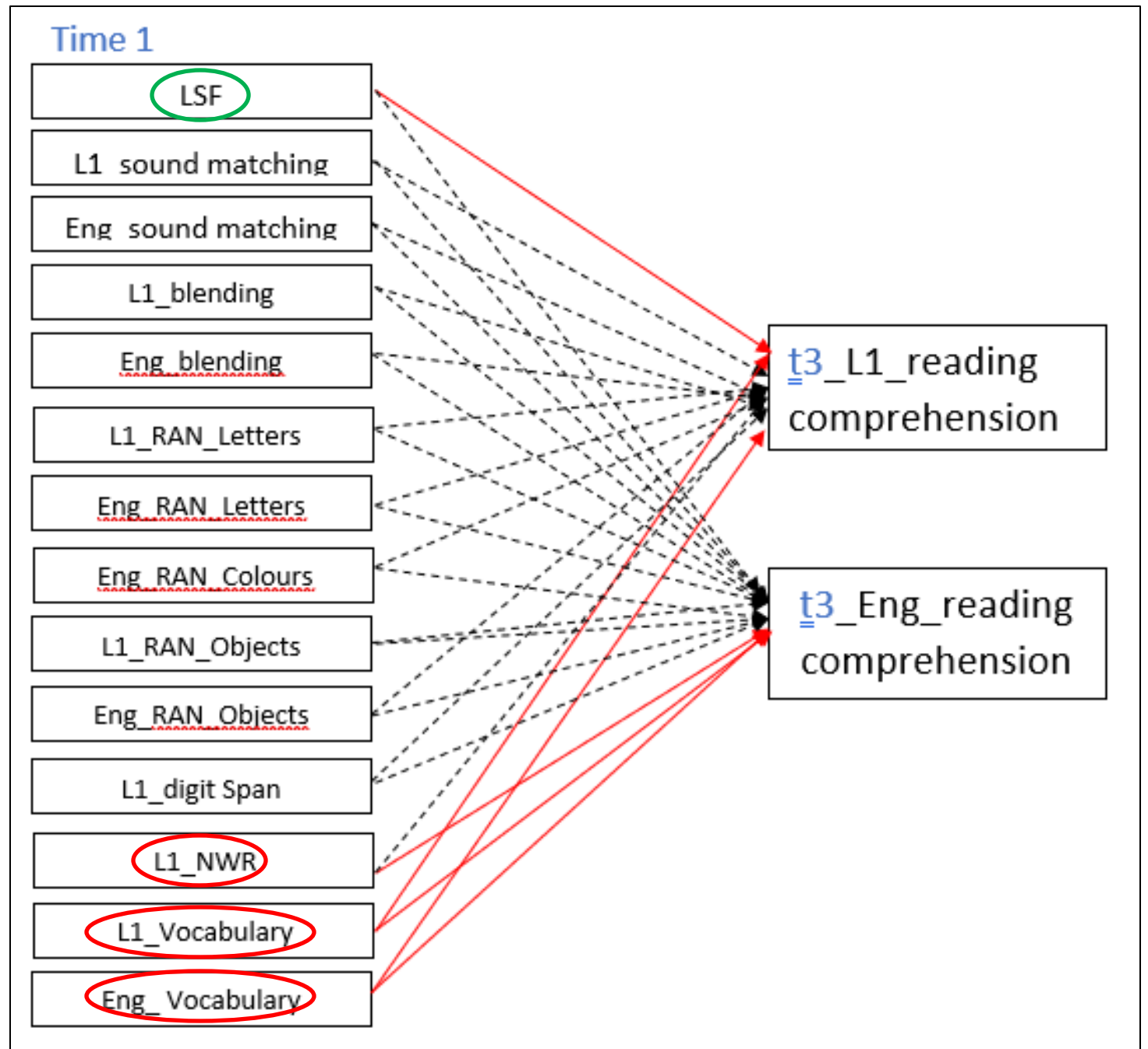
isiXhosa



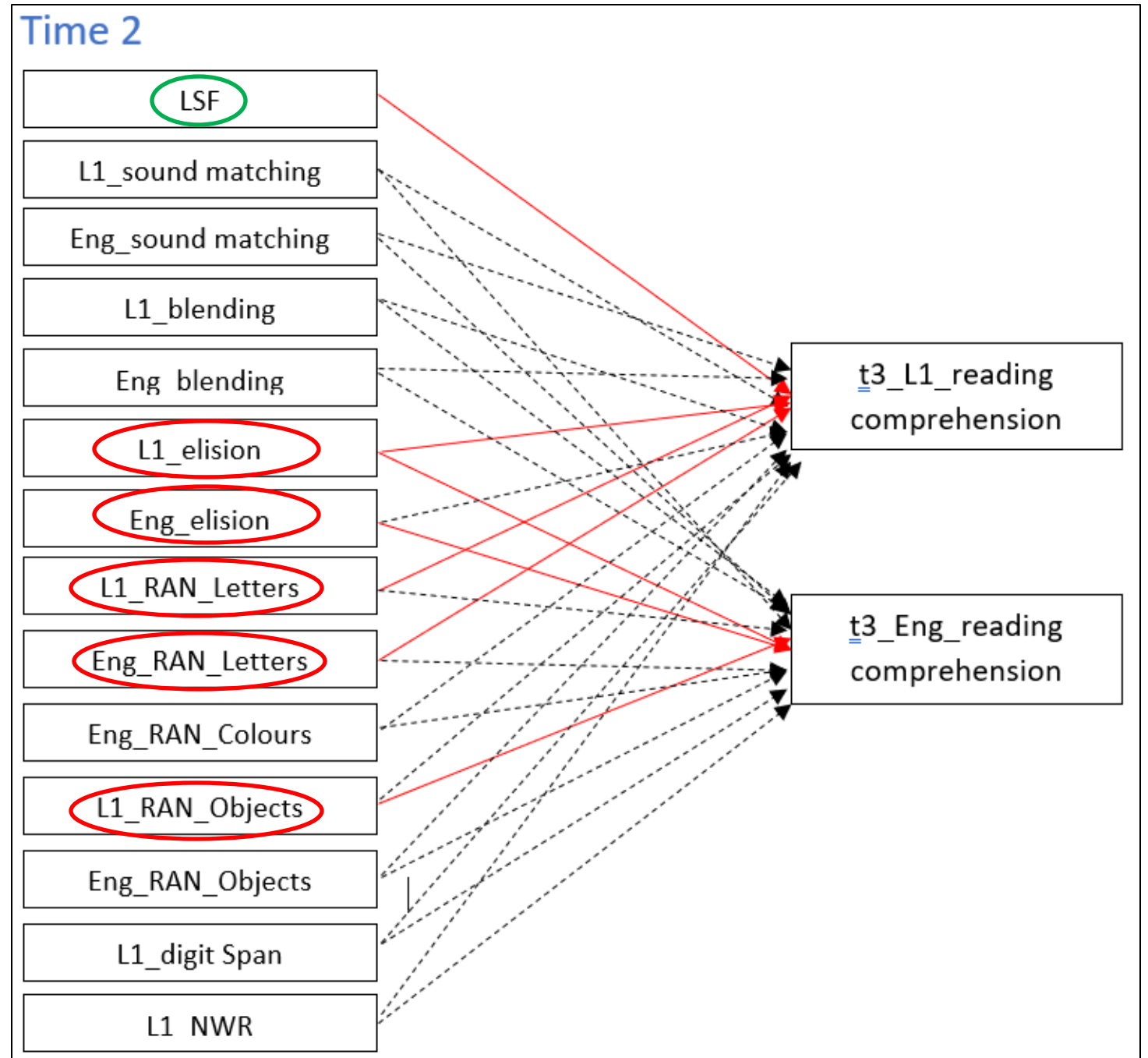
isiZulu



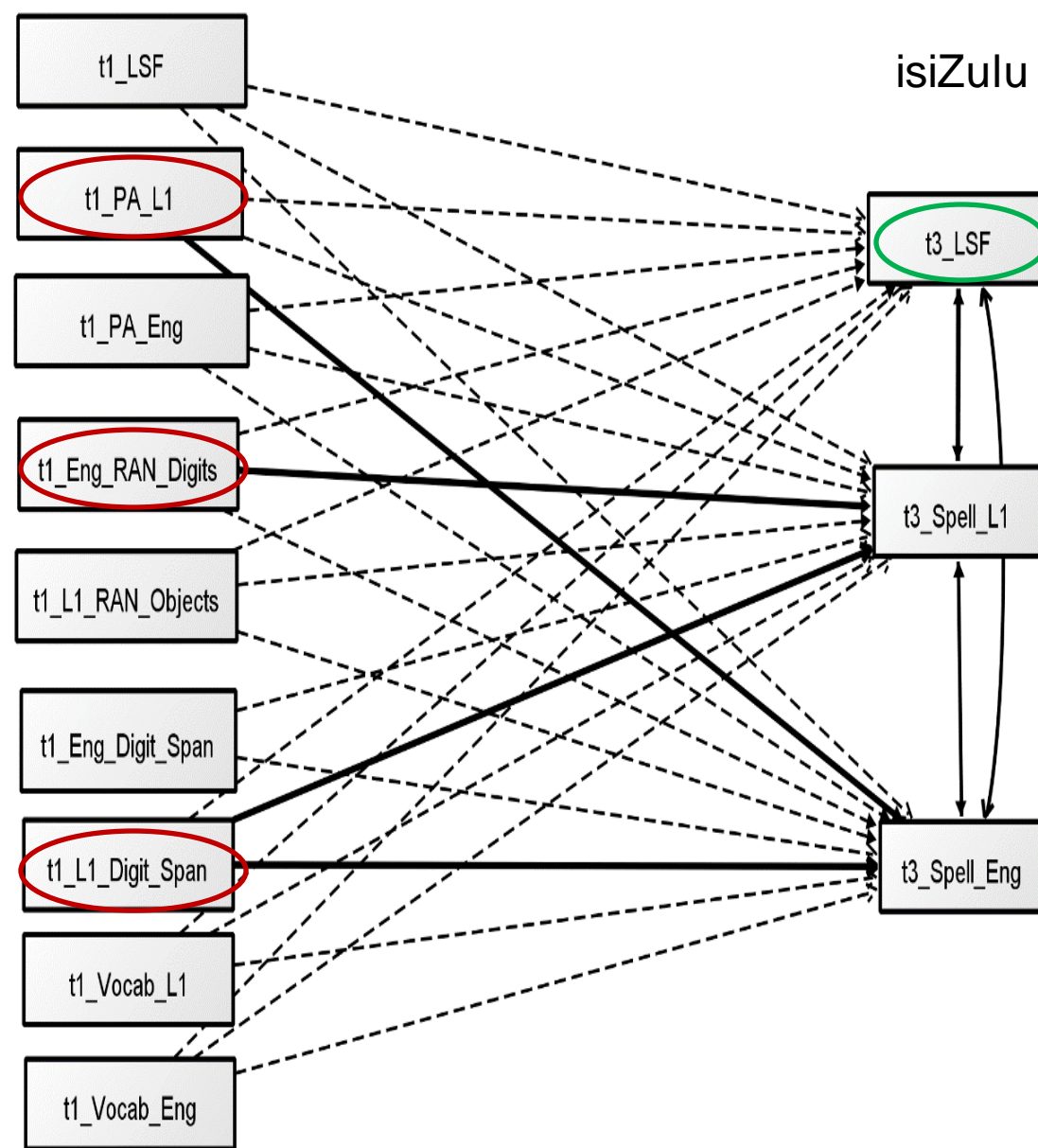
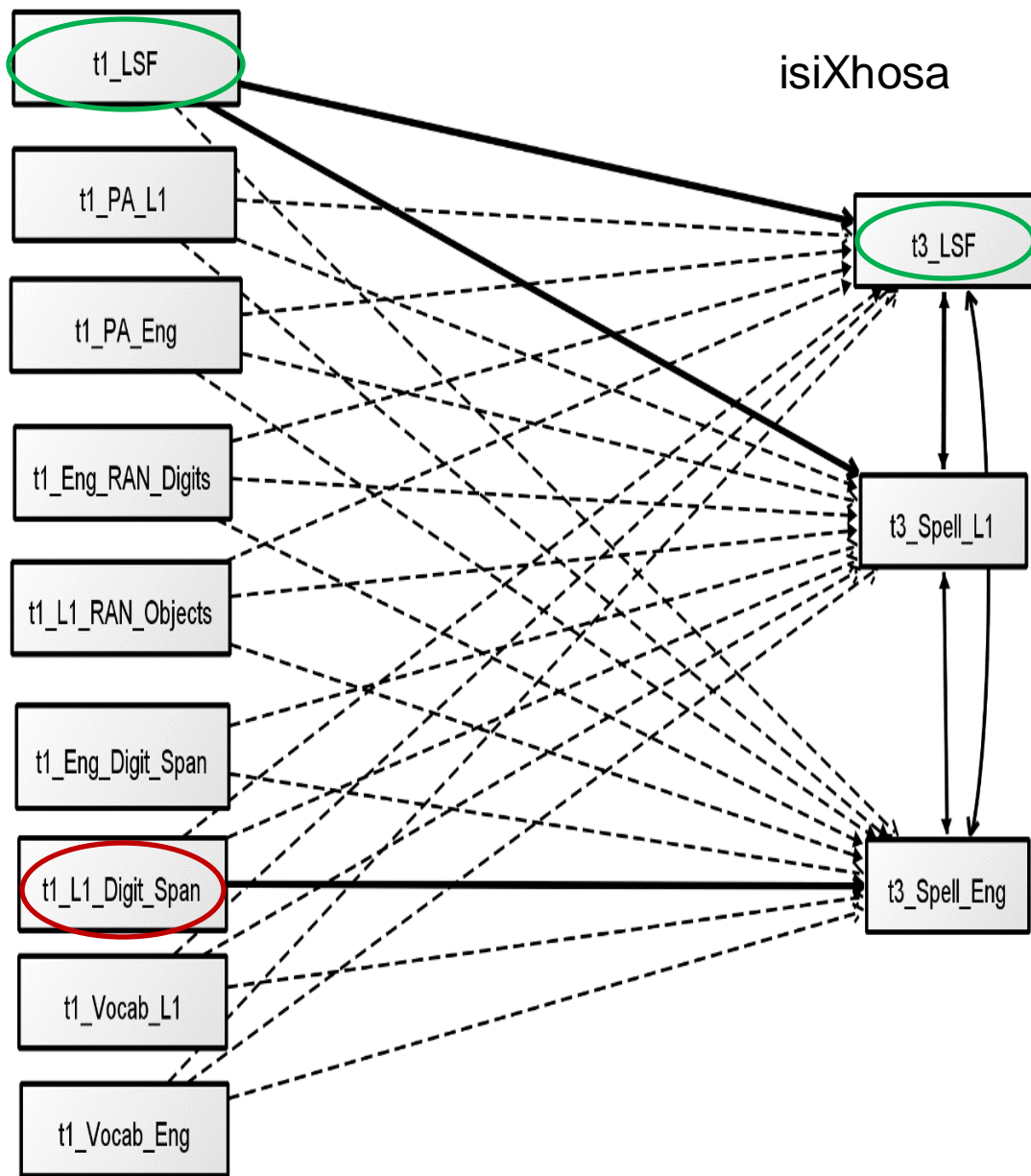
Grade 2 term 1
predictors of
reading
comprehension
Northern Sotho



Grade 2 term 3
predictors of
reading
comprehension
Northern Sotho



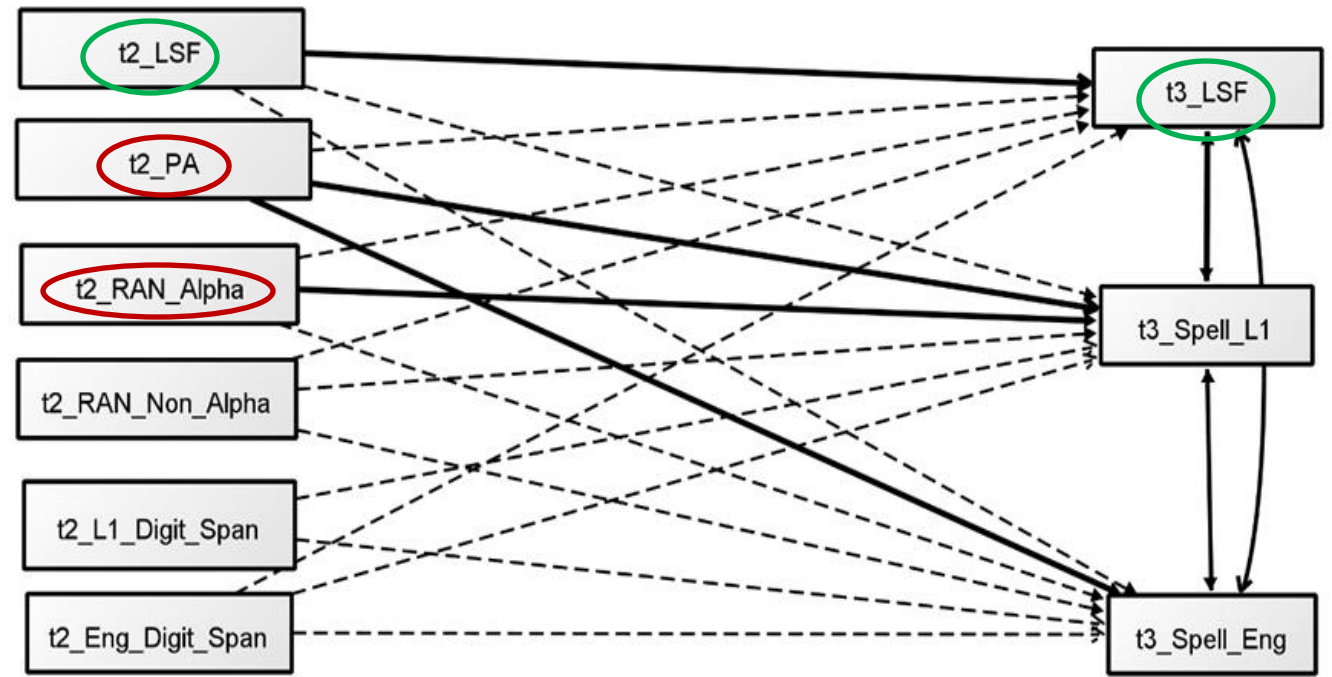
Grade 1 predictors of spelling (isiXhosa & isiZulu)



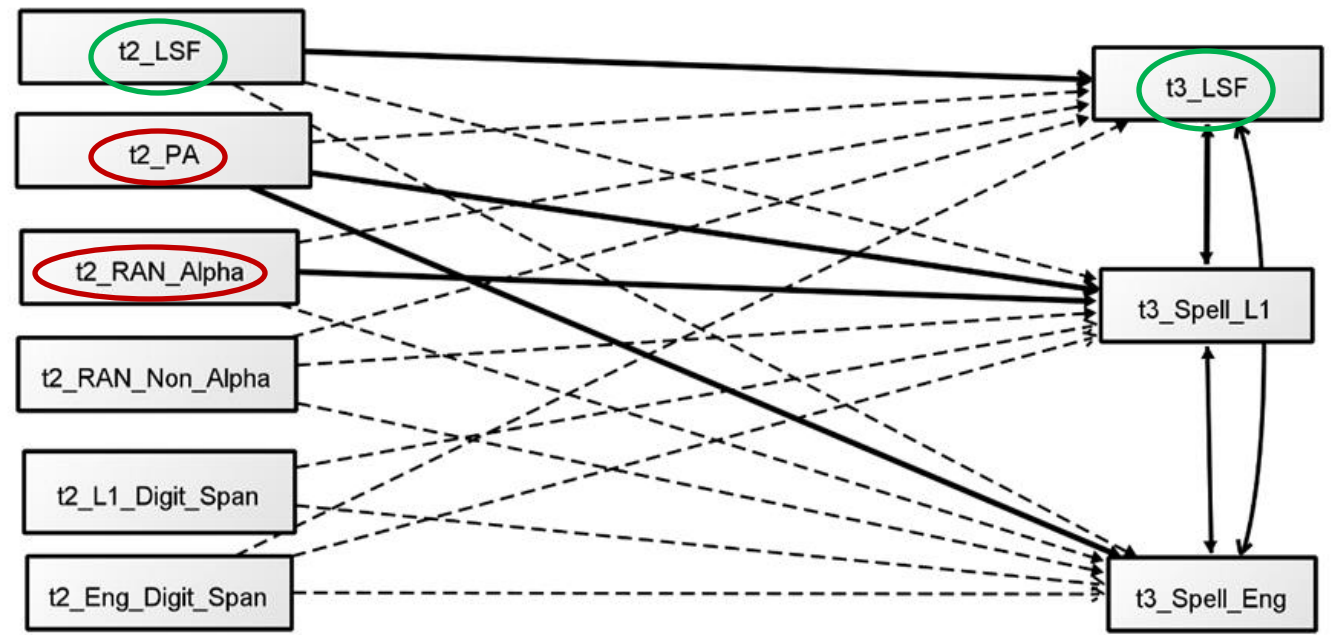
Grade 3 term 1
predictors of
spelling

isiXhosa &
isiZulu

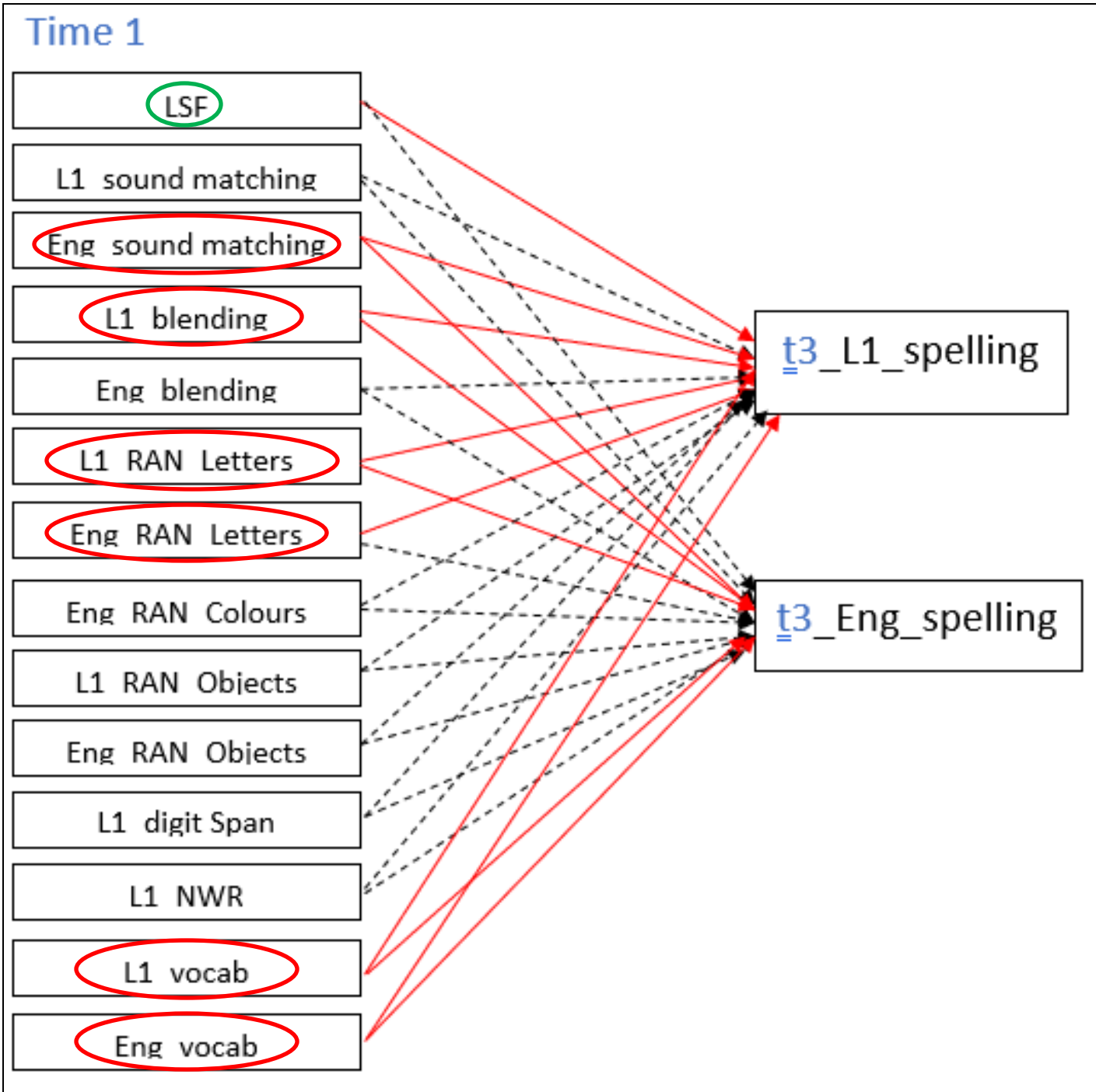
isiXhosa



isiZulu

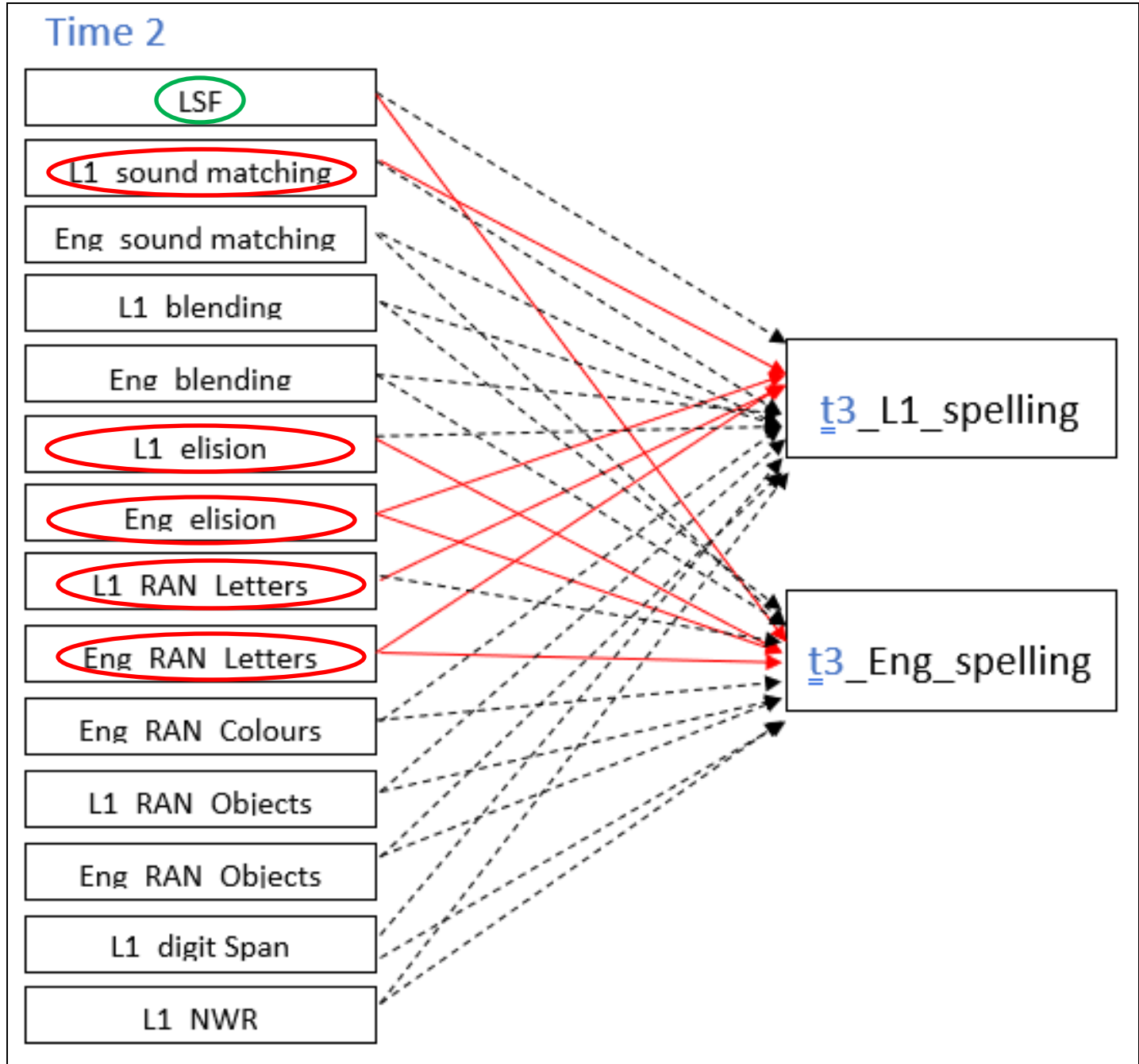


Grade 2 term 1
predictors of
spelling
Northern Sotho



Grade 2 term
3 predictors of
spelling

Northern
Sotho



Summary of longitudinal predictors of comprehension and spelling

- Knowledge of **letter sound correspondences** in Grade 1, 2 and beginning of Grade 3, specifically the ability to automatically recall these correspondences, **significantly and consistently predicts outcomes in reading comprehension and spelling in all three African languages, and in English.**
- PWM is a more consistent early predictor of literacy outcomes in our context, *when PA skills are not yet firmly established.*
- Once PA skills are better developed (time 2), they are more robust predictors of literacy outcomes than PWM.
- Alphanumeric rapid naming is more related to reading fluency, but also predicts spelling (all groups) and reading comprehension (NS group).

Conclusion

- Bilingual phonological processing skills do develop over time, even when systematic literacy instruction is interrupted.
- The development of PA skills supports the acquisition of letter-sound correspondences, which in turns, supports decoding.
- Automatic decoding supports fluent reading, and fluent reading supports comprehension.
- The development of PA skills in the South African context is slow in the first two years of schooling . This means that a significant number of children only start to decode in Grade 3, and thus they struggle to read for meaning, as their reading is not fluent enough to support comprehension.

- Some cognitive-linguistic skills are transferable between African languages and English – this means skill transfer is not limited to languages with similar phonological and orthographical structures.
 - Children can use all the resources that they acquire: some L1 PP skills predict English literacy, and some English PP skills predict L1 literacy skills.
 - Learning to read is a story of **specifics** and **universals**
 - specifics, because it does, especially early on, matter how different levels of a language (morphemes, syllables, phonemes) are engaged, and children start decoding once they understand these language-specific rules.
 - universals, because skills such PA, memory and automaticity, which are, to some extent, maturational support reading in any language.

Combining phonics and whole language



Recommendations for teaching reading in African languages

- Teach the alphabetic principle **early and often**, as part of a structured literacy approach.
- Structured literacy *includes* phonics and explicit teaching, but structured literacy isn't only phonics.
- Provide children with rich oral environments in both the ECD and foundation phase - rich vocabularies support the development of PA skills, which in turn, support children to grasp the alphabetic principle.
- Provide *much* more explicit guidance in the curriculum to Grade R and foundation phase teachers on how to engage children throughout the day in activities that enhance the development of all the foundation skills of reading – they are all equally important.

In closing



THANK YOU