

Exploring the impact of a story-based teacher training programme on language and early literacy, and broader cognitive development in 4- and 5-year-olds

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Wordworks Little Stars Research Project











Acknowledgements



Wordworks Little Stars Research Project





Stellenbosch UNIVERSITY IYUNIVESITHI UNIVERSITEIT





Overview

Reading: a brief introduction

• Reading levels in South Africa, and the importance of preschool oral language for reading

The aims of our work

- Wordworks Little Stars programme: overview and rationale
- Study objectives and design

Results

- (1) Skills targeted in the intervention;
- (2) Language directly taught in the intervention;
- (3) Broader skills not directly targeted or taught.

Conclusions

• What did we find? What have we learned? What do we need to do next?

Reading in South Africa

Reading ability predicts a wide range of outcomes for an individual

• Education success, employment, lifetime earnings, wellbeing (WLF, 2015).

Literacy levels in South Africa are extremely poor

- South Africa last (out of 57 countries) in PIRLS (G4 children) in 2021, with 81% of children at a level indicating that they cannot read for meaning;
- No improvement since PIRLS 2018 when 72% failed to attain basic standard.

Limited impact of literacy interventions in South Africa

- Early grade reading studies begin in Grade 1 or above (Grigg et al., 2016);
- Lack of study rigour makes it hard to evaluate their efficacy (Carter et al., 2024).

The preschool oral language foundations of reading

Reading comprehension is underpinned by preschool language and knowledge

- Oral language skills in preschool predict reading at 9 years (LARRC & Chiu, 2018)
- Teacher professional development and good quality language interventions in preschool support reading outcomes in high-income countries (Dickinson & McCabe, 2001).

Children starting school in South Africa may lack the foundations for literacy

- Up to 50% of children in Grade 1 lack basic alphabet knowledge (Willis et al., 2022).
- Few low-income children have access to books and language-rich early learning environments in the home (Naude et al., 2003; Carroll, 2011).

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The Little Stars programme

Overview

- 36-week preschool programme using a story-based approach designed to support language and knowledge critical to later reading;
- targets code-related skills related to later word reading, such as awareness of letter sounds; and meaning-related skills related to comprehension of text, such as vocabulary and story structure;
- provides professional development and resources for teachers.





Supporting early language and literacy teaching in pre-Grade R

An early literacy programme by Wordworks

The Little Stars Programme: Activities and their rationale

- song or rhyme *reinforce vocabulary*
- role play *try out new words and phrases*
- story retell *narrative structure*
- teacher read big book print concepts
- children tell story with their own little book enjoyment and motivation
- draw favourite part *expression*
- teacher writes key words *value and purpose*
- create 3D objects fine motor and visual motor skills
- listen to sounds in words phonological skills



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The Little Stars Programme: Feasibility

Training

 teachers given resources, scripted guides, and upfront and regular training for 6-8 months.

Teaching programme

- requires only 15-30 minutes per day;
- can be integrated into daily teaching programme - compatible with range of programme structures.

Materials

• affordable and Creative Commons licensed.



Study objectives

- Is the Little Stars classroom programme perceived as being useful and feasible for teachers with limited formal training to implement effectively in underresourced contexts?
- What is the effect of a resource-based training programme on teachers' teaching practices and on interaction in the classroom?
- What is the effect of the story-based intervention programme on children's early literacy and language skills, and broader areas of cognitive development?

Study objectives

- Is the Little Stars classroom programme perceived as being useful and feasible for teachers with limited formal training to implement effectively in under-resourced contexts?
- What is the effect of a resource-based training programme on teachers' teaching practices and on interaction in the classroom?
- What is the effect of the story-based intervention programme on children's early literacy and language skills, and broader areas of cognitive development?
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Study groups and design

Two language groups

 isiXhosa and Afrikaans children attending Early Childhood Development (ECD) centres and their teachers.

Randomised control trial for each language group

- each language group had an intervention group and a wait-list control group random assignment at ECD level (not child-level);
- random selection of up to 5 children aged 50-60 months per centre;
- influence of child-level baseline (Time 1) scores on outcome (Time 2) scores and key additional child- and classroom-level variables.

Ethical approval obtained through University of Stellenbosch [N21/05/047]

Study assessments

Pre-intervention (Time 1)

- child performance: (1) Skills targeted in the intervention; (3) Broader skills not directly targeted or taught;
- age, gender, height, and vocabulary knowledge;
- teacher experience, classroom environment, school fees (proxy for SES).

Post-intervention (Time 2 – after 26 weeks)

• repeated measures from Time 1 and also (2) vocabulary directly taught in intervention.

Caregivers' (subsample) report of Home Learning Environment (ELOM)

Study timeline

November 2021: orientation session
February & March 2022: baseline data collection (Time 1)
February 2022: 2 days of training for teachers in intervention group
March – August 2022: implementation of programme for intervention group; Monthly workshops for teachers (2.5hrs)
July 2022: One coaching site visit by trainers
August 2022: post-intervention data collection (Time 2 – 26 weeks into programme)
August – December 2022: training for teachers in control group

Child assessments: outcome measures

(1) Skills targeted in the programme

• *3 measures:* emergent language and literacy; print and phonological awareness; narrative comprehension and production (all T1 and T2)

(2) Language directly taught in the programme

• *1 measure:* vocabulary taught in the programme (T2 only)

(3) Broader skills not directly targeted or taught in the programme

• Early Learning Outcomes Measure (ELOM): total scores [informed by: Gross Motor; Fine Motor and Visual Motor Integration, Emergent Numeracy and Maths; Cognition and Executive Function, Emergent Language and Literacy].

(1) Targeted by programme: Emergent Language and Literacy subscale from ELOM

Purpose and overview

- assess foundations of word reading and reading comprehension;
- outcome variable for skills taught in programme.

Assessed skills

 ability to speak in full sentences and relate a logical account of events with correct language usage; naming of common objects; understanding of a story that is told to them; and recognition of initial sounds in words.



4 & 5 YRS ASSESSMENT (1) Targeted by programme: Print and phonological awareness from Early Literacy Protocol (ELP, Stellenbosch University)

Purpose and overview

- assesses precursors of word reading (code-related);
- outcome variable for skills targeted in programme.

Print awareness

 print concepts, environmental print, book concepts and orientation, and reading orientation.

Phonological awareness

• syllable segmentation, syllable synthesis, and identification of phonemes at start of words.



Environmental print	KFC	/1	
Environmental print	Stop sign	/1	
	Concept of book	/1	
	Front of book	/1	
Book concept and orientation	Where to start reading	/1	
	End of story	/1	
	Title	/1	
	What do we read (text)	/1	
Ponding orientation	Where do we start	/1	
Reading orientation	Text direction	/1	
	Next page	/1	

Phonological awaren	ess		
	Words into syllables	/4	
Segmentation	Words into sounds (2 phonemes)	/4	
	Words into sounds (3 phonemes)	/4	/ 12
	Words	/4	
Sunthasia	Syllables	/4	
Synthesis	Sounds into words (2 phonemes)	/4	
	Sounds into words (3 phonemes)	/4	/16
Analysis	Compound words	/4	
Analysis	Phonemes	/4	/8
	1.90 I. 1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.	1 14	

(1) Targeted by programme: Narrative skills using Multilingual Assessment Instrument for Narratives (MAIN; Gagarina et al., 2019)

Purpose and overview

- outcome variable for targeted skill;
- 6-picture sequence depicting a whole story in 3 2picture episodes.

Production: story retell

- coded for story structure elements (max = 17);
- coded for structural complexity (max = 9).

Comprehension: accuracy to questions

 understanding of goals, internal states, and theory of mind (max = 10).



(2) Language directly taught in the programme: Proximal Vocabulary Test (PVT)

Purpose and overview

- outcome variable for words taught in programme;
- 17 target words (7 nouns, 7 verbs and 3 adjectives) from wordlists for each picture book.



• production (from picture prompt) and comprehension (picture selection).





(3) Broader skills not directly targeted or taught: Total score from Early Learning Outcome Measures (ELOM)

Purpose and overview

• standardised tool for measuring effects of early learning programmes and readiness to learn in children aged 50-69 months (Dawes et al., 2020; Snelling et al., 2019).

Assessed skills

- (1) gross motor development
- (2) fine motor coordination and visual motor integration
- (3) emergent numeracy and mathematics
- (4) cognition and executive functioning
- (5) emergent literacy and language (ELL) also reported as separate target outcome



4 & 5 YRS ASSESSMENT

Complete-case approach

Series of models: linear model to linear mixed-effects models predicting Time 2 performance on the following measures:

(1) Skills targeted: 3 measures - ELL, ELP (print & phon. awareness), MAIN (narrative)
(2) Language directly taught: 1 measure - PVT (vocabulary)
(3) Broader skills not directly targeted or taught: ELOM total scores

Complete-case approach

Series of models: linear model to linear mixed-effects models predicting Time 2 performance

• Model 1. Two predictors: implementation quality, T1 score on measure*;

*Implementation Quality only for Taught Vocabulary (no initial measure of PVT)

Complete-case approach

Series of models: linear model to linear mixed-effects models predicting Time 2 performance

- Model 1. Two predictors: implementation quality, T1 score on measure*;
- Model 2. Three child-level covariates: initial vocabulary (CLT), age, gender, forwards stepwise selection only significant variables included;

*Implementation Quality only for Taught Vocabulary (no initial measure of PVT)

Child-level covariates: controls for potential influence on performance and development

Initial language

• Cross-Linguistic Test – production and comprehension of vocabulary.

Other child-level covariates

- age: 10 month age range in our sample (50 60 months);
- gender: in PIRLS 2021, South Africa had highest gender gap (favouring girls);
- height for age: stunting predicts educational outcomes (Mendez & Adair, 1999). Little evidence of stunting in our sample and some missing data so not treated as a covariate.

Covariate: vocabulary assessed with Crosslinguistic Lexical Task (CLT) at Time 1

Purpose and overview

- initial assessment of language to serve as covariate;
- cross-linguistic and cross-cultural tool for lexical assessment;
- available in isiXhosa and Afrikaans.

Assessment

- production (from picture prompt);
- comprehension (picture selection).





Complete-case approach

Series of models: linear model to linear mixed-effects models predicting Time 2 performance

- Model 1. Two predictors: implementation quality, T1 score on measure*;
- Model 2. Three child-level covariates: initial vocabulary (CLT), age, gender, forwards stepwise selection only significant variables included;
- Model 3a. Three classroom-level covariates added to Model 2: teacher experience, classroom quality (T2 ECERs), school fees (indicator of SES);

*Implementation Quality only for Taught Vocabulary (no initial measure of PVT)

Classroom-level covariates

Teacher experience

• 3 indicators: age, qualification, years of teaching this age group.

Classroom environment

 1 subscale from Early Childhood Environment Rating Scale – Extension (ECERS-E) *Literacy* (Sylva et al., 2006) and 2 subscales from ECERS-3 *Language and literacy* and *Learning activities* (Harms et al., 2014).

Socio-economic status (of ECD)

• school fees as a proxy (Henry & Giese, 2023).

Complete-case approach

Series of models: linear model to linear mixed-effects models predicting Time 2 performance

- Model 1. Two predictors: implementation quality, T1 score on measure*;
- Model 2. Three child-level covariates: initial vocabulary (CLT), age, gender, forwards stepwise selection only significant variables included;
- Model 3a. Three classroom-level covariates added to Model 2: teacher experience, classroom quality (T2 ECERs), school fees (indicator of SES);
- Model 3b. Model 3a + classroom-level random effects to capture remaining variability that exists between classrooms.

*Implementation Quality only for Taught Vocabulary (no initial measure of PVT)

Our study samples

	isiXh	osa		Afril	kaans
	Intervention	Control		Intervention	Control
Ν	42	40	Ν	60	58
Age	54.67	56.08	Age (months)	55.35	54.67
Gender	22 girls 20 boys	24 girls 16 boys	Gender	31 girls 29 boys	33 girls 25 boys
Height-for-age Z score	31	.02	Height-for-age Z score	43	.16
Initial vocab. (CLT) Factor score	56	69	Initial vocab. (CLT) Factor score	.47	.39

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isiXhosa Language Group results

(1) skills targeted in the programme:
 Emergent Language and Literacy (ELL – ELOM); Print and Phonological Awareness (ELP); Narrative Production and Comprehension (MAIN)

(2) language taught in the programme: Vocabulary (PVT)

(3) Broader skills not directly targeted or taught: ELOM total scores

1) Skills targeted in programme: isiXhosa

	Intervention		Control	
	Time 1	Time 2	Time 1	Time 2
Emergent Language and Literacy (ELL)	10.11	12.07	10.41	12.95
Print and phonological awareness (ELP) <i>Factor score</i>	44	.47	25	.61
Narrative (MAIN) <i>Factor score</i>	-1.16	.37	99	.34

isiXhosa: T2 Emergent Language and Literacy scores



isiXhosa: T2 print & phonological awareness (ELP)



isiXhosa: T2 narrative skills (MAIN)





Models 2, 3a, and 3b were not a better fit than Model 1

Model 1 $R^2 = .067$

Significant predictors: T1 MAIN

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 Emergent Language and Literacy (ELL – ELOM); Print and Phonological Awareness (ELP); Narrative Production and Comprehension (MAIN)

(2) language taught in the programme: Vocabulary (PVT)

(3) Broader skills not directly targeted or taught: ELOM total scores

2) Language directly taught in programme: isiXhosa

	Intervention		Control	
	Time 1	Time 2	Time 1	Time 2
Emergent Language and Literacy (ELL)	10.11	12.07	10.41	12.95
Print and phonological awareness (ELP) <i>Factor score</i>	44	.47	25	.61
Narrative (MAIN) Factor score	-1.16	.37	99	.34
Vocabulary (PVT) Factor score	n/a	15.57	n/a	11.93

isiXhosa: T2 taught vocabulary (PVT)







Model 2 was better fit than Model 1

Model 2 R² = .339

Significant predictors: Implementation Quality T1 vocabulary (CLT)

isiXhosa Language Group results

 (1) skills targeted in the programme:
 Emergent Language and Literacy (ELL – ELOM); Print and Phonological Awareness (ELP); Narrative Production and Comprehension (MAIN)

> (2) language taught in the programme: Vocabulary (PVT)

(3) Broader skills not directly targeted or taught: ELOM total scores

3) Broader skills not directly taught or targeted: isiXhosa

	Intervention		Control	
	Time 1	Time 2	Time 1	Time 2
Emergent Language and Literacy (ELL)	10.11	12.07	10.41	12.95
Print and phonological awareness (ELP) <i>Factor score</i>	44	.47	25	.61
Narrative (MAIN) Factor score	-1.16	.37	99	.34
Vocabulary (PVT) <i>Factor score</i>	n/a	15.57	n/a	11.93
ELOM total score	47.07	59.25	45.80	58.89

isiXhosa: T2 ELOM total scores



4 & 5 YRS ASSESSMENT

3.000 2.500 2.000 Estimated beta coefficient 1.500 Model 1 was best fit 1.000 Model 1 R^2 = .555 0.500 **Significant predictors: T1 ELOM total** 0.000 Model 1: T1 score & Model 2: child-level Model 3a: classroom- Model 3b: Model 3a implementation covariates level covariates +random effects -0.500 quality T1 ELOM Implementation Quality Child-level covariates Teacher Experience □ Classroom Quality Fees (SES)

isiXhosa: ELOM total Time 1 and Time 2 cut scores (% of group)



T1 intervention T2 intervention T1 control T2 control

isiXhosa Language Group: Summary and key points

Time 1 ability was a significant unique predictor of Time 2 performance

- the sole significant predictor of Emergent Language and Literacy (ELOM ELL), Narrative (MAIN), and ELOM total scores, for both intervention and control groups.
- a significant predictor for Print and phonological awareness (ELP).

Implementation quality predicted scores for vocabulary directly taught in the programme:

• in addition to initial vocabulary (CLT) ability.

We did not capture all important differences between classrooms:

• T2 Print and phonological awareness (ELP) predicted by T1 score and random effects.

Afrikaans Language Group results

(1) skills targeted in the programme:
 Emergent Language and Literacy (ELL – ELOM); Print and Phonological Awareness (ELP); Narrative Production and Comprehension (MAIN)

(2) language taught in the programme: Vocabulary (PVT)

(3) Broader skills not directly targeted or taught: ELOM total scores

1) Skills targeted in programme: Afrikaans

	Intervention		Control	
	Time 1	Time 2	Time 1	Time 2
Emergent Language and Literacy (ELL)	12.02	14.75	12.50	13.87
Print and phonological awareness (ELP) <i>Factor score</i>	43	.80	74	.09
Narrative (MAIN) <i>Factor score</i>	11	1.25	76	.61

Afrikaans: T2 Emergent Language and Literacy scores



Afrikaans: T2 Print & Phonological Awareness (ELP)





Model 3a was best fit

Model 3a $R^2 = .362$

Significant predictors: T1 ELP Teacher experience T2 ECERs negative predictor

Afrikaans: T2 narrative skills (MAIN)





Model 3b $R^2 = .388$

Significant predictors: T1 vocabulary (CLT) T1 MAIN **Other differences (random** effects) between classrooms made a difference

Afrikaans Language Group results

 (1) skills targeted in the programme:
 Emergent Language and Literacy (ELL – ELOM); Print and Phonological Awareness (ELP); Narrative Production and Comprehension (MAIN)

(2) language taught in the programme: Vocabulary (PVT)

(3) Broader skills not directly targeted or taught: ELOM total scores

2) Language directly taught in programme: Afrikaans

	Intervention		Control	
	Time 1	Time 2	Time 1	Time 2
Emergent Language and Literacy (ELL)	12.02	14.75	12.50	13.87
Print and phonological awareness (ELP) <i>Factor score</i>	43	.80	74	.09
Narrative (MAIN) Factor score	11	1.25	76	.61
Vocabulary (PVT) Factor score	n/a	27.78	n/a	25.64

Afrikaans: T2 taught Vocabulary (PVT)







Models 2 was better fit than Model 1

Model 2 R² = .587

Significant predictors: Implementation Quality T1 vocabulary (CLT)

Afrikaans Language Group results

(1) skills targeted in the programme:
 Emergent Language and Literacy (ELL – ELOM); Print and Phonological
 Awareness (ELP); Narrative Production and Comprehension (MAIN)

(2) language taught in the programme: Vocabulary (PVT)

(3) Broader skills not directly targeted or taught: ELOM total scores

3) Broader skills not directly targeted or taught: Afrikaans

	Intervention		Control	
	Time 1	Time 2	Time 1	Time 2
Emergent Language and Literacy (ELL)	12.02	14.75	12.50	13.87
Print and phonological awareness (ELP) <i>Factor score</i>	43	.80	74	.09
Narrative (MAIN) Factor score	11	1.25	76	.61
Vocabulary (PVT) Factor score	n/a	27.78	n/a	25.64
ELOM total score	50.38	66.29	51.04	58.83

Afrikaans: T2 ELOM total scores



4 & 5 YRS ASSESSMENT

6.700 5.700 4.700 Estimated beta coefficient 3.700 2.700 1.700 0.700 -0.300 Model 1: T1 score & Model 2: child-level Model 3a: classroom- Model 3b: Model 3a +random effects implementation covariates level covariates -1.300 quality -2.300 T1 ELOM Implementation Quality Child-level covariates □ Classroom Quality Teacher Experience Fees (SES)

Model 3a was best fit

Model 3a $R^2 = .508$

Significant predictors: Implementation Quality T1 ELOM total scores Initial vocabulary (CLT) Teacher Experience

Afrikaans: ELOM total Time 1 and Time 2 cut scores (% of group)



T1 intervention T2 intervention T1 control T2 control

Afrikaans Language Group: Summary and key points

Time 1 ability was a significant unique predictor of Time 2 performance

• for all measures except Emergent Language and Literacy (ELOM ELL).

Initial vocabulary (CLT) was a significant unique predictor of several T2 scores:

• Emergent Lang. and Lit. (ELOM ELL), Narrative (MAIN), Taught vocabulary (PVT).

Implementation quality predicted T2 taught vocabulary and ELOM total:

• the intervention made a difference for directly taught and broader skills.

We captured some, but not all, important differences between classrooms:

 teacher experience a unique positive predictor of Print and phonological awareness and ELOM total; random effects explained additional variance in T2 narrative (MAIN); Classroom Quality (ECRERs) had negative effect on ELL and ELP.

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What did we find?

Positive impact of the Little Stars intervention on language taught in the programme:

- intervention group obtained higher scores than controls on PVT in both language groups;
- implementation quality was a significant unique predictor (in addition to initial vocab).

Initial performance at start of the study was a strong predictor of outcomes:

- significant unique predictor for all T2 scores for isiXhosa and 3/4 T2 scores for Afrikaans;
- regardless of intervention or other classroom factors, initial ability is important predictor.

Age and gender did not predict significant unique variance in outcomes.

Classroom-level covariates made a difference for Afrikaans group:

- teacher experience positive impact on Print and phonological awareness, and ELOM total;
- classroom quality negative impact on Print and phonological awareness and ELL: those with better resourced classrooms gained less between T1 and T2.

What have we learned?

Preschool interventions with resources and teacher training can make a difference:

 strong, robust and conservative test of the Little Stars intervention through a Randomised Control Trial (RCT) that took initial ability into account.

Confirmed the reliability and sensitivity of several cross-linguistic literacy measures:

- indicators of narrative, print and phonological awareness, and vocabulary each formed a coherent single factor and predicted change over a 26 week period;
- value of using proximal assessments close to programme content (e.g., PVT).

Possible, but also challenging, to run an RCT in this context:

- able to recruit and train sufficient teachers for statistical power, but substantial amounts of child- and classroom-level missing data;
- child absences may have reduced effectiveness of intervention for isiXhosa group;
- Time 2 scheduled at 26 weeks (not 36) to allow controls access to programme.

What do we need to do next?

Understand what explains ability for children starting grade R:

- weak relations between Time 1 scores and the Home Learning Environment (subsample);
- neglible relations between height for age and Time 1 scores.

Understand better what other variables predict a quality preschool classroom environment (and its impact) and how best to measure this in the South African context:

- Early Children Environment Rating Scales (ECERS) used in multiple contexts, but did not capture all (positive) variation between classrooms is this an appropriate measure?
- attendance varied across individuals and groups capture this systematically to determine impact on progression, and how to remove barriers to attendance.

Encourage more Randomised Control Trials (RCTs) to test effectiveness of interventions:

 comparison against control group critical to evaluate effectiveness; even control groups saw 20+% increase in children obtaining 'on track' ELOM total scores at Time 2.

Thank you! Questions?

Please email with additional questions, comments, and suggestions: <u>k.cain@lancaster.ac.uk</u>

Additional materials and dissemination

- Presentation on child outcomes at annual meeting of Society for the Scientific Study of Reading, July 2025 and completion of academic journal article for publication;
 - Chapter on teacher perspective of the programme's usefulness and feasibility to appear in *"Reimagining Early Childhood Care and Education: Bridging Global Practices with 21 Century Innovations"*
 - Research briefs on project content and initial findings available at Wordworks website:https://www.wordworks.org.za/little-stars-report-1/

Wordworks Little Stars Research Project





Stellenbosch



