A Parental mHealth Resource Targeting Emergent Literacy: An Experimental Study

Cornelia Scheepers, Renata Eccles, Shabnam Abdoola, Jeannie van der Linde (PhD), Marien Graham (PhD)

Abstract

Emergent literacy abilities of young children are strong predictors of future academic success however, biological and environmental risks can impact their progress. Parental interventions that promote home-based stimulation of preschoolers can enhance literacy development and ensure school readiness. mHealth technology may be a viable approach to offer parents increased access to emergent literacy resources. The effect of a parental mHealth resource targeting emergent literacy abilities was investigated. Eighty-two parent-preschooler (four-to five-year-old) dyads were randomly assigned to a control or experimental group based on age and gender. The parents of preschoolers in the experimental group received the mHealth application resource for 17 weeks. At post-test, no significant between-group differences were identified. Both groups showed significant within-group differences at post-test. Only eight of the parents in the experimental group (n = 42) used the mHealth application more than 50% of the active days. Most of the feedback received from parents regarding the application was positive. Parents may require more support when implementing mHealth emergent literacy resources.

Keywords*:* emergent literacy, preschoolers, parental resource, mHealth

Introduction

Emergent literacy abilities of children entering school are strong predictors of future academic success (Chan & Sylva, 2015; Hilbert & Eis, 2014; Xu, Chin, Reed, & Hutchinson, 2014). Research suggests that children's emergent literacy skills can predict their outcomes regarding the development of skilled versus problematic reading in their early school years (Wilson & Lonigan, 2010). Children's literacy skills develop from birth (Howie et al., 2017a), however, several biological and environmental risk factors can impact development (Olivier, Anthonissen, & Southwood, 2010). Biological risks include a family history of reading deficits, attention difficulties, as well as cognitive, language and hearing impairment (Olivier et al., 2010). Environmental risks that directly influence emergent literacy development are limited proficiency in the language of learning and teaching (LoLT), low maternal education level and/or socio-economic status (SES) (Olivier et al., 2010; Rowe, Denmark, Harden, & Stapleton, 2016).

The combination of risk factors can have a cumulative negative impact on emergent literacy development and, thus, later academic outcomes (Olivier et al., 2010; Rowe et al., 2016). In low and middle-income countries

(LMIC), such as South Africa, children predominately receive education, including Reception year (Grade R), in English although only 9,6% of the country speak English as a first language (Statistics South Africa, 2011a). Many children are therefore schooled from Grade R onwards in English with limited proficiency as education in their first language is inaccessible (Sharma, Vallabh, & van der Merwe, 2013). Consequently, children have difficulty acquiring optimal literacy abilities due to language barriers within the educational setting (Rosenman & Madelaine, 2012).

Additionally, poor early language skills and subsequent limited literacy abilities in young children are consistently related to limited parent education (Rowe et al., 2016; Sharma et al., 2013). These factors result in the maintenance of intergenerational poverty for families from low SES (Wasik & Hindman, 2011). Children of parents with a high level of education and SES have a broader vocabulary and are on average six months ahead with literacy development compared to children of parents with no formal education and a lower SES (Rowe et al., 2016; Wildschut, Moodley, & Aronstam, 2016). In South Africa, these factors are pertinent as over 30,3 million people live in low socio-economic settings, of which 66,8% are between the ages of zero to 17 years old (Statistics South Africa, 2017). Furthermore, only 28,4% of the population older than 20 years have high school completion as their highest education level (Statistics South Africa, 2011a). A large proportion of the population is therefore at risk for literacy difficulties as evidenced by the limited literacy abilities of school-going children in South Africa (Department of Basic Education, 2017).

Literacy performances of South African children

Since South Africa's underperformance in the 2006 *Progress in International Reading Literacy Study* (PIRLS) important changes to the education system have been implemented, with a particular focus on reading literacy (Howie, van Staden, Tshele, Dowse, & Zimmerman, 2012). Initiatives such as the 'Drop All and Read' campaign and the National Reading Strategy document have been implemented to improve literacy acquisition (Howie, van Staden, Tshele, Dowse, & Zimmerman, 2012). Ten years after the initial PIRLS report, however, South Africa, still ranked the lowest out of 50 countries in the PIRLS 2016 report (Howie et al., 2017b). One of the key findings in the recent report was that 78% of learners do not have basic literacy skills by the end of Grade Four, in contrast to only four percent of learners internationally (Howie et al., 2017b). This shows the effect of the cumulative risks while the PIRLS 2016 report highlights the impact of environmental risks that influence literacy development. Only 21% of Grade Four children in South Africa who participated in the study spoke English, the prominent LoLT, at home and learners living in remote rural areas had the lowest reading literacy achievement (Howie et

al., 2017b). Data analysed from a National Education and Evaluation Development Unit of South Africa study also stated that 41% of Grade Five rural English additional language learners were 'non-readers of English' (Rule & Land, 2017; Spaull & Draper, 2015). Innovative approaches and resources targeting emergent literacy are therefore needed to promote literacy development in young children and ensure later educational success. The PIRLS 2016 report recommends parental involvement as a vital resource in promoting children's early literacy development prior to school entry as they are the primary person in their children's lives (Reese, Sparks, & Leyva, 2010).

Parental interventions and mobile technology

Developing parental knowledge of supportive literacy, including strategies and activities to implement in the home environment, can increase parental involvement to foster the development of literacy skills (Neumann, Hood, & Neumann, 2009). Access to literacy resources at home is integral to children's literacy development (Jung, 2016) since a positive relationship between the home literacy environment (HLE) and children's future language and literacy skills exists (Baroody & Diamond, 2012). Evidence suggests that families from low SES have a lack of access to literacy and print resources especially in the first language, thus contributing to less literacy exposure in the home environment (Trainin, Wessels, Nelson, & Vadasy, 2017). Parental interventions that promote home-based stimulation, and improve access to literacy resources are needed in LMIC to enhance literacy development and promote school readiness (Okeyo, 2015).

Mobile technology and applications may be innovative approaches to promote literacy development by providing information to parents through short message services (SMS) and smartphone-based applications. Worldwide, mHealth, mobile communication technologies in health care, is rapidly expanding within the electronic health system (Free et al., 2010). Benefits of mHealth services for families and the health care system include reduced costs and increased access to resources (Catwell & Sheikh, 2009). Furthermore, mHealth services are accessible in all settings due to the increasing availability of mobile phone technology (Surka, Edirippulige, Steyn, Gaziano, Puoane, & Levitt, 2014). Globally, owners of mobile phones have grown from one billion in 2000 to more than seven billion in 2015 (Iribarren, Cato, Falzon, & Stone, 2017). The number of smartphone users in South Africa in 2018 was 20.4 million (35% of the total population), and for 2019 the estimated number of smartphone ownership is 22 million (38% of the total population) (Holst, 2019). mHealth technology may be a viable approach to offer parents in LMIC access to literacy resources and enhance the HLE. Several pilot studies implemented in

LMIC support the use of mobile technologies to deliver specific health interventions including mHealth awareness and prevention programmes (Folaranmi, 2014).

mHealth resources

Read to Kids is an mHealth awareness and prevention initiative that uses mobile technology to provide books across India and focuses on improving children's literacy development (Pearson, 2018). The goal of the application is to engage parents in the education process as parents often lack confidence in their own ability to read to their children because of the strength of their language skills (Pearson, 2018). The application was piloted for one year and reached over 203,000 households of which over 57,000 individuals browsed the library and read at least one book (Arkedis, Heinkel, Synowiec, Eberhardt, & Krakoff, 2018). Almost 7,000 households also changed their reading habits and individuals read from the application at least four times a month, an indicator of reading habit creation and behaviour change (Arkedis et al., 2018). *Read to Kids* gave parents the confidence to be more involved in their children's literacy development. Examples of mHealth programmes in Africa include the use of SMS to distribute health information, and prevention messaging to specific target groups (Folaranmi, 2014).

The *Wordworks* application, a mobile technology developed in South Africa, is designed to equip parents and early childhood development (ECD) practitioners of young children aged birth to five years with ideas and information to support early learning through everyday activities (Innovation Edge, 2018). It extends parental knowledge and provides practical ideas on how to talk, play, sing and share books with children (Innovation Edge, 2018). The free *Wordworks* application is available in English, isiXhosa, isiZulu, and Afrikaans and users receive activity related messages from Monday to Thursday and an inspirational message on Friday. Similarly, *CareUp* is a South African mobile application designed to stimulate literacy through mobile messaging, audio files, activities and resources for parents and ECD practitioners of children aged four to five years (Rudge, 2017). The content of *CareUp* is sourced from *Wordworks' Every Word Counts* (EWC) programme (The Reach Trust, 2018). The application was first piloted in the Western Cape at ten preschool sites with 15 ECD practitioners and 120 parents in a 15-week pilot (Roberts & Spencer-Smith, 2017). The pilot investigated ECD practitioners' and parents' views and showed promising results. The study was then upscaled to 50 additional sites in 2017. The majority of participating parents found the activities useful and 69% of the parents read stories to their children at least once a week whereas 67% of the parents did not read stories to their children before using the application

(Innovation Edge, 2017). Given the positive outcome and good potential of *CareUp* on a relatively large sample of parents in the Western Cape, further independent testing is needed in other low-income areas in South Africa.

In low-income areas, preschoolers' emergent literacy development is at risk due to various risk factors (Howie et al., 2017a). Literacy development could be encouraged by improving parental access to literacy stimulation resources for use in the HLE. The investigation of targeted mHealth resources and the evaluation of the effectiveness thereof have been recommended (van der Linde, 2015). This study aimed to determine the effect of a parental mHealth resource on emergent literacy (print concepts, alphabet knowledge, and emergent writing and spelling) in preschoolers between the ages of 4.0 and 5.11 years.

Method

Setting and participants

Data collection took place at six ECD centres, in the central business district (CBD) of Tshwane, with English as the LoLT. The City of Tshwane is the capital of South Africa with a total population of 2,921,488 and 23,2% of the population being between zero and fourteen years of age (Statistics South Africa, 2011b). Approximately 24,3% of the population in Tshwane is classified as living in poverty with less than two percent (1,1%) of the population living on US$2 per day (Statistics South Africa, 2011b). Thus, the City of Tshwane is considered a lower-middle-income area.

Hundred and thirteen parents provided consent to participate with their preschoolers in the research study. Preschoolers were required to be 4.0 to 5.11 years of age, have typically developing speech and language abilities, attend an ECD centre with English as LoLT and English had to be one of the preschoolers' primary languages. Preschoolers had to pass a developmental screening regarding speech and language abilities based on parental concern as well as a hearing screening. Parents of preschoolers had to be between the ages of 18 and 59 years, proficient in English (Grade Five level or above) and own an Android smartphone to be included in the study.

After eligibility screening, the total number of preschoolers was 84 with 82 parents, as one parent had three preschoolers participating in the study. Preschoolers were randomly assigned to the research groups based on age and gender. At the post-test, two preschoolers and their parents were excluded from the sample as one preschooler transferred schools and the other only had a 12-week intervention period in comparison to the rest of the sample that received 16-20 weeks. The final sample consisted of 82 parent-preschooler dyads participating (Table 3.1). The parent background information questionnaire provided information regarding preschoolers' language

proficiency and use as well as their parents' employment and the highest education levels. English was one of the primary languages of preschoolers, as well as the LoLT, although many preschoolers spoke additional languages which is typical in South Africa. Setting, employment and education assisted in identifying SES which predicts literacy outcomes (Rowe et al., 2016; Wildschut et al., 2016). Thus, the majority of parents within the sample received monthly incomes and were educated predicting better literacy outcomes for their children (Rowe et al., 2016; Wildschut et al., 2016).

Table 3.1: Demographic information of participants

	Percentage		
	Control Group	***Experimental Group***	***Total***
Preschoolers' pre-test ages (n=82)	**n=40**	**n=42**	**n=82**
4.0-4.11 years	55% (n=22)	61,9% (n=26)	58,5% (n=48)
5.0-5.11 years	45% (n=18)	38,1% (n=16)	41,5% (n=34)
Preschoolers' gender (n=82)	**n=40**	**n=42**	**n=82**
Male	32,5% (n=13)	35,7% (n=15)	34,1% (n=28)
Female	67,5% (n=27)	64,3% (n=27)	65,9% (n=54)
Preschoolers' most dominant language (n=81)[#]	**n=39**	**n=42**	**n=81**
English	71,8% (n=28)	61,9% (n=26)	66,7% (n=54)
Northern Sotho	7,7% (n=3)	19% (n=8)	13,6% (n=11)
Setswana	2,6% (n=1)	7,1% (n=3)	4,9% (n=4)
Sesotho	7,7% (n=3)	0% (n=0)	3,7% (n=3)
isiZulu	2,6% (n=1)	4,8% (n=2)	3,7% (n=3)
isiXhosa	2,6% (n=1)	2,4% (n=1)	2,5% (n=2)
Other	5,1% (n=2)	4,8% (n=2)	4,9% (n=4)
Employment of mother (n=77)[#]	**n=36**	**n=41**	**n=77**
Employed	91,7% (n=33)	92,7% (n=38)	92,2% (n=71)
Unemployed	8,3% (n=3)	7,3% (n=3)	7,8% (n=6)
Employment of father (n=59)[#]	**n=25**	**n=33**	**n=59**
Employed	100% (n=25)	93,9% (n=31)	96,6% (n=56)
Unemployed	0% (n=0)	6,1% (n=2)	3,4% (n=2)
Mother's highest education level (n=81)[#]	**n=39**	**n=42**	**n=81**
Less than Gr 8	2,6% (n=1)	0% (n=0)	1,2% (n=1)
Gr 9 – 10	0% (n=0)	2,4% (n=1)	1,2% (n=1)
Gr 11 - 12	23,1% (n=9)	11,9% (n=5)	17,3% (n=14)
Degree/Diploma	64,1% (n=25)	64,3% (n=27)	64,2% (n=52)
Post-graduate	10,3% (n=4)	21,4% (n=9)	16% (n=13)
Father's highest education level (n=65)[#]	**n=30**	**n=35**	**n=65**
No formal schooling	0% (n=0)	2,9% (n=1)	1,5% (n=1)
Gr 9 – 10	0% (n=0)	2,9% (n=1)	1,5% (n=1)
Gr 11 - 12	13,3% (n=3)	14,3% (n=5)	13,8% (n=9)
Degree/Diploma	63,3% (n=19)	57,1% (n=20)	60% (n=39)
Post-graduate	23,3% (n=8)	22,9% (n=8)	23,1% (n=15)

[#] Missing data: questionnaire not returned and/or incomplete answers to questions

Procedures

Ethical clearance (GW20190105HS) was obtained from the Research Ethics Committee of the Faculty of Humanities, University of Pretoria. Data collection took place at six ECD centres in the Tshwane area. Permission from principals of the ECD centres was obtained. A parent meeting was held at each ECD centre and preschoolers were not present. Data collection commenced once the study was explained, parents had read through the information leaflet, considered the inclusion criteria and informed consent was obtained. At the parent meeting, a developmental screening of speech and language abilities based on parental concern was conducted. Thirty-one of the 115 preschoolers that were screened obtained a referral for speech-language evaluation and were excluded from the study. The parents of the included preschoolers were then asked to complete the parent background information questionnaire while every second preschooler was assigned to the experimental group based on age and gender. Language background was not considered in the formation of the research groups as LoLT was part of the inclusion criteria. Parents in the experimental group were then given an mHealth literacy resource (*CareUp*) that served as the intervention. The application and content have been designed to use data only when downloading and have no further running costs (Innovation Edge, 2017). Wi-Fi was provided by the researcher to download the application onto the parents' smartphones. The researcher explained the use and content of the application and the parents were orientated on how to use the application. Parents' profiles on the mHealth application were completed according to assigned alphanumeric codes to maintain confidentiality.

After the parent meeting, the included preschoolers' hearing was screened in a quiet room during the day at their respective ECD centres. None of the preschoolers failed the hearing screening. Subsequently, the pre-test assessments commenced at the ECD centres during school hours using an early literacy protocol. Sixteen to 20 weeks (mean = 17 weeks, *SD* = 1.68) after the pre-test, participating preschoolers were reassessed using the same literacy protocol. During the 17 weeks, parents of the preschoolers in the experimental group facilitated literacy stimulation using the *CareUp* mobile application as an intervention resource. The 17-week intervention period correlates with the period of the *CareUp* pilot study done in the Western Cape that showed positive results (Innovation Edge, 2017). The assessment procedures on both occasions did not take longer than an hour per preschooler. Every parent received feedback regarding their preschoolers' performance after the post-test early literacy assessment.

After completing the post-test early literacy assessments, parents in the control group were given the opportunity to download the *CareUp* application. Data that tracked the experimental groups' parents' active days (log into the

application to open activities or read stories) of *CareUp* usage were downloaded. Based on the data received from the *CareUp* usage, the researcher contacted 31% (n = 13) of the parents that received the application to obtain feedback about their experience using the application. Parents (n = 13) were randomly selected from three categories based on the use of the application i.e. below average, average and above-average usage during possible active days. Three questions were posed to the parents to gather feedback. Firstly, *Did you use the CareUp application?* If parents replied Y*es* to the first question, the second question was *What did you enjoy about using the application?* and the third question was then *What were the challenges in using the application and would you use it in the future?* If the parents responded *No* to the first question, they were asked was *What made it difficult for you to use the application?* and the last question was, *What would have encouraged you to use the application?*

Materials and Apparatus

Screening measures for inclusion

The Parents' Evaluation of Developmental Status (PEDS) tools (Maleka, van der Linde, Glascoe, & Swanepoel, 2016) and hearScreen (Swanepoel, 2016) were conducted on all potential participants. Smartphones (Huawei P Smart and Huawei P10) were used to administer the PEDS developmental screening. The PEDS tools consist of 16 questions (10 open-ended and six multiple choice) that were posed to each parent. The screening identifies parental concerns regarding preschoolers' development in the following areas: global/cognitive; expressive language and articulation; receptive language; fine motor; gross motor; behaviour; social-emotional; and self-help skills (van der Linde, 2016). Participants were excluded if the developmental screening indicated a referral to a speech-language therapist. The hearScreen application was utilised to conduct hearing screening. A Samsung Galaxy 8 smartphone containing the hearScreen application and Sennheiser HD202 II supra-aural headphones (Louw, Swanepoel, Eikelboom, & Myburgh, 2017), calibrated to ISO/ANSI standards, were used for the screening. hearScreen is validated for use in schools and community-based settings (Louw et al., 2017). The hearing screening indicated a referral when the preschooler is unable to detect the intensity of 20 dB at 1000, 2000 or 4000 Hz.

Biographical case history

Each parent completed a researcher-developed parent background information questionnaire to obtain biographic and demographic information for an accurate description of the population (Shipley & McAfee, 2016).

Early literacy assessment

The Emergent Literacy and Language Assessment (ELLA) protocol (Willenberg, 2007) was administered on all participating preschoolers. The ELLA protocol, designed for the South African population, assesses specific domains required for the acquisition of emergent literacy skills (Sharma, Vallabh, & van der Merwe, 2013). There are ten sub-tests included in the ELLA protocol to assess three main domains of emergent literacy; namely, orientation to print skills (environmental print, concepts about print, and writing and spelling); knowledge of speech-print relationships (letter naming, sounds in words, rhyme recognition, and rhyme production), and language (vocabulary, word definitions, and fictional narratives) (Willenberg, 2007). For the current study only the specific emergent literacy domains, orientation to print skills and knowledge of speech-print relationships, of the ELLA protocol were examined. Fictional narratives, from the language domain, were also assessed because narratives form the bridge from oral language to literacy (Stadler & Ward, 2005). Adaptations to the protocol were made from the recommendations of previous research by Willenberg (2007), Olivier (2009) and Sharma et al. (2013). Assessment measures used to evaluate emergent literacy abilities of the ELLA subtests included the environmental print stimulus, Follow Me, Moon, Primary Spelling Inventory, Test of Preschool Early Literacy [TOPEL], rhyme recognition and production stimulus and School-age Language Assessment Measures [SLAM] (Table 3.2). The TOPEL is not standardised for the South Arica population and results were interpreted using raw scores. A voice recorder application (Huawei P Smart) was used to record the fictional narratives for later analysis. The ELLA protocol provides results for each subtest across domains and not an overall score for emergent literacy.

Table 3.2: Subtests of the ELLA protocol and the corresponding assessment measures

ELLA Protocol Subtests	Assessment measures
Orientation to print	
Environmental print	Environmental print stimulus (Sharma et al., 2013)
Concepts about print	Follow Me, Moon (Clay, 2000)
Writing and spelling	Primary Spelling Inventory (Bear, Invernizzi, Templeton, & Johnston, 2000)
Knowledge of print-speech relationships	
Letter naming	TOPEL (Lonigan, Wagner, Torgesen, & Rashotte, 2007)
Sounds in words	
Rhyme recognition	Rhyme recognition and production stimulus (Olivier, 2009)
Rhyme production	
Language	
Fictional narratives	SLAM (Crowley & Baigorri, 2015)

Intervention

CareUp is a recent South African mobile application that empowers parents to improve literacy development of children aged four to five years through regular messaging and push notifications with ECD content linked to activities, instructions, and exercises (The Reach Trust, 2018). The content of *CareUp* is available in four languages: isiXhosa, Afrikaans, English, and isiZulu (Rudge, 2017; Wordworks, 2017). The EWC programme from which the content is sourced is evidence-based and supports language and literacy development in very young children through the use of parenting programmes (Stefano, O'Carroll, & Comrie, 2015). *CareUp* provides parents with quality resources through audio files offering information, activities, stories and inspirational messages (Innovation Edge, 2017). Parents received motivational messages once a week, three weekly reminder notifications and daily messages with activities and instructions around a theme that is aligned with the National Curriculum Framework (The Reach Trust, 2018). Additionally, parents can access a selection of culturally relevant stories on the application to read at any time (The Reach Trust, 2018).

Data analysis

The ELLA protocol is used as a criterion measure to track progress from the baseline to post-test assessments. Results from the assessment measures were analysed individually using raw scores and then calculated to percentage out of the possible maximum score for each subtest. The fictional narratives were analysed according to Applebee's system for scoring narrative stages (Applebee, 1978). The data were tested for normality and not all the variables' p-values for the Shapiro-Wilk test were greater than 0.05 indicating the data is not normally distributed thus nonparametric tests were used. The Mann-Whitney test was used to test for between-group differences for continuous data (environmental print, concepts about print, writing and spelling, letter-naming, sounds in words, rhyme recognition and production) while the Chi-Square test was used for categorical data (fictional narratives). The Wilcoxon signed-rank tests for differences within the control and experimental group, respectively, for continuous data. The Cramer's V test evaluated possible within-group differences in categorical data including Fictional narrative: Narrative stage subtest. A statistically significant difference is present if the p-value is less than 0.05.

Data regarding the *CareUp* usage were analysed after a frequency distribution was run to determine the percentage of days parents actively used the *CareUp* application by at least opening the application during the intervention period. Furthermore, a thematic analysis was conducted to analyse a portion of parents' (n = 13) experiences after using the application.

Results

Baseline assessment results from the ELLA protocol indicated that the experimental group (EG) and control group (CG) were comparable as no significant differences in performance were noted in any subtests; environmental print (p = .721), concepts about print (p = .273), writing and spelling (p = .625), letter-naming (p = .430), sounds in words (p = .820), rhyme recognition (p = .272) and production (p = .588) (Table 3.3). Similarly, no significant between-group differences across subtests were identified at post-test. Post-test within-group comparisons of both the CG and EG showed significant improvement in six out of seven ELLA protocol subtests (environmental print, concepts about print, writing and spelling, letter naming, sounds in words and rhyme recognition). Only the rhyme production subtest did not show significant within-group improvements for either the CG (p = .317) or the EG (p = .157) at post-test. At post-test, 96% (n = 79) of preschoolers were also unable to produce words that rhyme with the test item even after an example was given.

Sounds in words showed the best average performance across the entire sample (n = 82) at the pre-test (CG: 43,81%; EG: 42,07%) and post-test (CG: 56,78%; EG: 55,30%). Preschoolers across the sample (n = 82) performed the poorest in the writing and spelling (CG pre-test: 3,45%, CG post-test: 5,73%; EG pre-test: 2,36%, EG post-test: 5%) and rhyme production (CG pre-test: 0%, CG post-test: 0,3%; EG pre-test: 0%, EG post-test: 0,5%) subtests at pre- and post-test. Preschoolers in both research groups displayed limited evidence of either pretend writing or invented spelling ability. In the post-test, 47,5% (n = 19) of the preschoolers in the CG scribbled or attempted to write the first letter of their name while 50% (n = 23) of the EG preschoolers were able to write their names.

Table 3.3: Comparison of ELLA protocol subtests pre- to post-test between- (Mann-Whitney test) and within- (Wilcoxon signed-rank test) groups

ELLA Protocol Subtest	Max possible score	Control Group (n=40)					Experimental Group (n=42)					Between-group post-test
		Pre-test		Post-test		Within-group	Pre-test		Post-test		Within-group	
		Mean (SD)	Mean as % of max possible score	Mean (SD)	Mean as % of max possible score	p-value	Mean (SD)	Mean as % of max possible score	Mean (SD)	Mean as % of max possible score	p-value	p-value
Environmental print	52	21.13 (9.55)	40,63%	27.00 (10.48)	51,92%	0.000*	21.45 (9.34)	41,25%	28.02 (11.17)	53,88%	0.000*	0.721
Concepts about print	24	3.88 (3.11)	16,17%	5.05 (2.73)	21,04%	0.017*	3.33 (3.33)	13,88%	4.38 (2.56)	18,25%	0.015*	0.273
Writing and spelling	11	0.38 (0.54)	3,45%	0.63 (0.59)	5,73%	0.004*	0.26 (0.45)	2,36%	0.55 (0.50)	5%	0.001*	0.625
Letter naming	36	11.25 (6.79)	31,25%	15.80 (7.15)	43,89%	0.000*	11.29 (8.49)	31,36%	15.10 (8.23)	41,94%	0.000*	0.430
Sounds in words	27	11.83 (5.49)	43,81%	15.33 (5.01)	56,78%	0.000*	11.36 (4.78)	42,07%	14.93 (4.83)	55,30%	0.000*	0.820
Rhyme recognition	15	2.03 (3.21)	13,53%	5.70 (3.28)	38%	0.000*	1.31 (1.97)	8,73%	4.83 (3.08)	32,2%	0.000*	0.272
Rhyme production	10	0.00 (0.00)	0%	0.03 (0.16)	0,3%	0.317	0.00 (0.00)	0%	0.05 (0.22)	0,5%	0.157	0.588

* statistically significant at $p < .05$

The fictional narrative skills of the CG and EG showed no significant between-group differences for the pre-test (p = .238) or post-test responses (p = .452) (Table 3.4). Within-group comparisons identified a significant difference between the pre- and post-test fictional narratives responses of both the CG (p < .001) and EG (p = .001). Preschoolers in the CG progressed from 30% (n = 12) producing sequence stories in the pre-test to 45% (n = 18) presenting chain narratives in the post-test. The EGs' preschoolers improved from 24% (n = 10) heap stories to 43% (n = 18) primitive stories during the post-test. Across the sample, 65% (n = 53) of preschoolers produced heap and sequence stories at pre-test, while at post-test 77% (n = 63) of preschoolers progressed to predominately producing primitive and chain narratives.

Table 3.4: Narrative stage raw score crosstabulation for between-group (Chi-Square test) and within-group differences (Cramer's V test)

Fictional narratives: Narrative stage	**Control Group (n=40)**			**Experimental Group (n=42)**			**Between-group**	
	Pre-test	**Post-test**	**Within-group**	**Pre-test**	**Post-test**	**Within-group**		
	Frequency (%)	**Frequency (%)**	**p-value**	**Frequency (%)**	**Frequency (%)**	**p-value**	**Pre-test p-value**	**Post-test p-value**
Heap stories	10 (25%)	1 (2,50%)	0.000*	10 (23,80%)	0 (0%)	0.001*	0.238	0.452
Sequence stories	12 (30%)	5 (12,5%)		21 (50%)	13 (30,95%)			
Primitive stories	10 (25%)	16 (40%)		7 (16,67%)	18 (42,86%)			
Chain stories	8 (20%)	18 (45%)		4 (9,52%)	11 (26,19%)			

* statistically significant at p < .05

Analysis of the *CareUp* usage suggested no association between the active days and the outcomes of preschoolers in the EG as the p-value for each of the subtests was more than 0.05. The *CareUp* usage data showed that the majority (81%) of the parents that received the application used it less than 50% of the active days (Figure 3.1). The frequency distribution indicated that six parents were active for 60% of the days while four parents were active at least 70% of the days. Thus, only ten (23,8%) of the parents actively used the application during the intervention period. The average number of active days (ranging from 1 to 91 days) across the EG for the 17-week intervention period was 24 days (SD = 25.54). Parents (59,5%) predominately used the application at the beginning of the intervention period and less in the last four weeks. Ninety-five percent of parents (n = 40) did not disable the reminder and activity notifications within the application settings. The highest number of activities that were opened by a parent for at least 10 seconds over the 17-week period was 72 (mean = 23.50; SD = 27.46).

Five of the parents opened 28 stories (mean = 6.83; *SD* = 10.09) for at least 15 seconds during the 17 weeks and 48% of the parents (n = 42) did not open any of the stories available on the application. Parents had the option to select the language preference of the application. The majority of parents (n = 38) chose English (90,48%) while two of the parents chose Xhosa (4,76%) and two parents selected Afrikaans (4,76%), indicating that English was the preferred language.

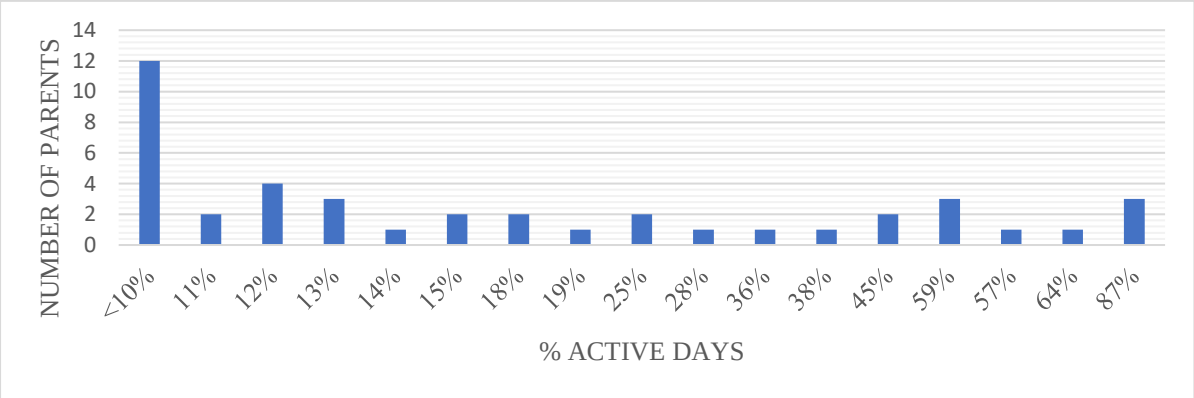

Figure 3.1: Percentage of active days parents used the *CareUp* application

To gather parents' perceptions of the application, the parents (n = 11) that used the application were asked what they enjoyed about the application. Responses were grouped and five (45%) of the parents mentioned that they enjoyed the parent-child interaction, while six (55%) commented on the value of the stories and activities - "*The stories and activities showed me how to engage with my children.*" Secondly, parents were asked to highlight the challenges they experienced in using the application and to indicate if they would continue to utilise it. Nine of the parents (81%) did not experience any challenges and reported they would use the application in the future. A challenge identified by one of the parents was that their child did not want to concentrate during the activity. Another parent mentioned the application stopped working and took up too much phone storage. The two parents that did not use the application at all were asked: "What made it difficult for you to use the application?" One parent responded she did not have data to use the application, although data was not required to access the resources, and the other parent reported time constraints.

Discussion

Results indicated that preschoolers in the EG did not perform significantly better than preschoolers in the CG at post-test. *CareUp* usage analysis also suggested no association between the active days and the performances of preschoolers in the EG. Despite what was considered to be a user-friendly and cost-effective mHealth resource that provided access to literacy resources, parents did not consistently utilise the *CareUp* application. A possible

contributing factor to the findings of the current study was parents' limited use of the mHealth resource during the 17-week intervention period. Usage data indicated that 81% of the parents that received the application used the resource less than 50% of the active days. These findings are in contrast with several pilot studies implemented in LMIC that support the use of mHealth technology as an innovative approach to stimulate literacy by providing parents with information through mobile applications (Innovation Edge, 2018; Pearson, 2018). Since less than one-third of the parents (n = 10) actively used the application in the current study, the group was too small for statistical analysis to determine whether *CareUp* had an effect on preschoolers' performances. In contrast, the *CareUp* pilot study reported encouraging uptake and usage data for the parents as 67% accessed *CareUp* at least three times per week (Roberts & Spencer-Smith, 2017). Parents' self-report responses after the pilot study suggested increased positive perceptions regarding their own knowledge and more frequent engagement with their children (Roberts & Spencer-Smith, 2017). Similarly, parents in the present study reported improved parent-child engagement when using the stories and activities from the application. The *CareUp* application seemed to be a viable approach to provide parents with information and literacy resources to enhance the HLE. The *CareUp* pilot study, however, differed from the current study in that an initial workshop was held to orientate participants to the mHealth resource and usage was monitored through school and home visits. Workshops and home visits may counter barriers that influence the usage of mHealth resources (Roberts & Spencer-Smith, 2017). Parents' usage of mHealth resources is influenced by the lack of knowledge and support to use mobile technology in the home environment (Papadakis, Zaranis, & Kalogiannakis, 2019).

Parental beliefs, opinions, and attitudes directly relate to the use of mobile technology (Papadakis et al., 2019). Eighty-one percent (n = 9) of the parents considered the application as innovative and easy to use. Twenty-seven percent of parents (n = 3) identified some challenges in the current study including technical problems (n = 2) such as the application stopped working or took up too much phone storage (n = 1) and inconsistent use of the application due to limited time available (n = 1). These factors are similar to those reported in the pilot study, including a lack of interest or confidence in using the service; lack of data to download or update content, challenging home circumstances and receiving reminders and messages at inconvenient times (Roberts & Spencer-Smith, 2017).

Parents that received the *CareUp* application were encouraged and supported through three weekly reminders and daily activity messages send by the application. Parents (59,5%) in the present study predominately used the application at the beginning of the intervention period. Only two of the parents (n =40) disabled the reminder and

activity notifications within the application settings thus parents' usage and engagement with the application was facilitated. If the application, however, was not opened regularly the reminder and activity notifications automatically stopped. This may be the reason why parents used *CareUp* less towards the last two months as they were not encouraged to continue using the application. Future recommendations for application developers may be to continue sending notifications regardless of parents' usage of the application or rather using SMS messaging that is not dependent on opening the application regularly. The use of text messaging for communication transcends age and SES and is the most widely used smartphone feature in all countries (Nielsen, 2013). Several studies of parent text messaging programmes show positive impacts on children's academic outcomes (Cabell, Zucker, DeCoster, Copp, & Landry, 2019). Text messaging is thus a promising alternative to send reminders and activities instead of application notifications.

Within-group comparisons at post-test showed significant differences in the mean scores of the environmental print (CG: 51,92%; EG: 53,88%), concepts about print (CG: 21,04%; EG: 18,25%), writing and spelling (CG: 5,73%; EG: 5%), letter naming (CG: 43,89%; EG: 41,94%), sounds in words (CG: 56,78%; EG: 55,30%) and rhyme recognition (CG: 38%; EG: 32,2%) subtests. These emergent literacy domains typically emerge and/or mature between two to five years of age (Owens, 2014; Paul & Norbury, 2012; Shipley & McAfee, 2016). The improved results shown in the within-group comparisons for six of the seven ELLA protocol subtests are most likely attributable to normal maturation and long-term preschool influence. There were also no significant between-group differences for fictional narratives while within-group comparisons identified a significant difference for both the CG ($p < .000$) and EG ($p = .001$).

Narratives are foundational to early literacy development as they form the bridge from oral language to literacy (Stadler & Ward, 2005). Children between the ages of four and five years are expected to produce primitive and chain narratives (Paul, 2007). Preschoolers in both groups predominately produced heap and sequence stories in the pre-test, and more primitive and chain narratives in the post-test. Both groups' preschoolers thus, progressed along the typical continuum of narrative stage development from the pre- to post-test.

The rhyme production subtest was the only subtest that did not show significant within-group improvement and the subtest in which preschoolers across the sample performed the poorest. The rhyme production abilities of the participating preschoolers were a concern as rhyming is integral to later reading development and is an important aspect of children's early literacy experiences (Xu et al., 2014). The developmental sequence of phonological awareness (PA) skills (e.g. letter naming, blending and segmentation, rhyme recognition and rhyme production)

observed in English first language speakers might not, however, apply to English additional language speakers, the population included in the present study (Raynolds, López-Velásquez, & Olivo Valentín, 2017). The differences in the development of rhyming skills between first and additional language English speakers in South Africa may be attributed to the fact that rhyme does not appear in African languages (Vermaak, 2006) and English first language speakers have greater exposure to English nursery rhymes (Raynolds et al., 2017). English additional language learners, therefore, find rhyming activities more difficult than other PA tasks, such as blending and segmentation (Vermaak, 2006). This is evident in the present study as preschoolers across the sample achieved better performances in the sounds in words subtest, which involved blending and segmenting words and sounds, than in the rhyme recognition and production subtests. English additional language learners, therefore, may not be exposed to rhyme during the period it emerges which may lead to the development of more sophisticated PA skills such as blending and segmentation instead. English additional language learners thus require added exposure to support the acquisition of rhyming skills and as a result future literacy skills. It is recommended that the *CareUp* application should support the concept of rhyming for additional language speakers when African language options are introduced. Furthermore, the Department of Basic Education (DBE) needs to target rhyming skills along with the whole PA continuum by training ECD practitioners on how to manage the development of foundational literacy skills in diverse populations. Practitioners should link early learning programmes to the home environment through parent education initiatives, story-telling groups for parents and children, and/or maternal literacy classes about opportunities for early learning (Borisova, 2013).

Conclusion

Research suggests that mHealth resources are an innovative solution that can support aspects of preschoolers' emergent literacy development, however, in the current study no effect was documented after a 17-week intervention period. Parents inconsistently utilized the application although they identified it as an easy to use and innovative mHealth resource that provided access to literacy resources in the home environment. Parents may require additional support face to face such as pre-intervention workshops and not only virtual frequent reminders when implementing mHealth emergent literacy resources to improve preschool children's emergent literacy outcomes. For future research, it is recommended that the ELLA protocol should be refined by providing two versions, one suitable for the preschool population and one for the early school grades. This will ensure the abilities that are evaluated are more specific to the different age ranges. Research exploring parent practices, perceptions, parent-child interactions, and usage patterns of mHealth resources with additional support is

recommended. Further empirically designed studies on the effectiveness and use of parental mHealth applications in low resourced settings are warranted to clarify the effect on emergent literacy development.

References

Applebee, A. (1978). The child's concept of story. Chicago: University of Chicago Press.

Arkedis, J., Heinkel, L., Synowiec, C., Eberhardt, M. J., & Krakoff, I. (2018). *Leveraging mobile technology for parental engagement in the early years*. India. Retrieved from https://comms.worldreader.org/wp-content/uploads/2018/05/READ2KIDS_digital-1.pdf

Baroody, A. E., & Diamond, K. E. (2012). Links among home literacy environment, literacy interest, and emergent literacy skills in preschoolers at risk for reading difficulties. *Topics in Early Childhood Special Education*, *32*(2), 78–87. https://doi.org/10.1177/0271121410392803

Bear, D., Invernizzi, M., Templeton, S., & Johnston, F. (2000). *Words their way: Word study for phonics, vocabulary and spelling instruction* (2nd ed.). Ohio:Prentice Hall.

Borisova, I. (2013). *Emergent literacy investing early for exponential outcomes*. US. Retrieved from http://www.savethechildren.org/atf/cf/%7B9def2ebe-10ae-432c-9bd0-df91d2eba74a%7D/EDU_ELM_BRIEF_WHITE_PAPER_FINAL_AUGUST_2013.PDF

Cabell, S. Q., Zucker, T. A., DeCoster, J., Copp, S. B., & Landry, S. (2019). Impact of a parent text messaging program on pre-kindergarteners' literacy development. *AERA Open*, *5*(1), 1–16. https://doi.org/10.1177/2332858419833339

Catwell, L., & Sheikh, A. (2009). Evaluating eHealth interventions: The need for continuous systemic evaluation. *Plos Medicine*, *6*(8), 1–6. https://doi.org/10.1371/journal.pmed.1000126

Chan, L., & Sylva, K. (2015). Exploring emergent literacy development in a second language: A selective literature review and conceptual framework for research. *Journal of Early Childhood Literacy*, *15*(1), 3–36. https://doi.org/10.1177/1468798414522824

Clay, M. M. (2000). *Follow me, Moon*. Portsmouth, NH: Heineman.

Crowley, C., & Baigorri, M. (2015). *SLAM Dog Comes Home Cards*. Retrieved November 27, 2018, from https://www.leadersproject.org/2015/03/18/slam-dog-comes-home-school-aged-language-assessment-measure/

Department of Basic Education. (2017). *The early grade reading study (EGRS): Policy summary report*. Pretoria. Retrieved from https://www.education.gov.za/Portals/0/Documents/Publications/EGRS Policy Summary Report.pdf?ver=2017-08-15-092224-000

Department of Health. (2019). *MomConnect*. Retrieved March 19, 2019, from www.health.gov.za/index.php/mom-connect

Folaranmi, T. (2014). mHealth in Africa: Challenges and opportunities. *Perspectives in Public Health*, *134*(1), 14–15. https://doi.org/10.1177/1757913913514703

Free, C., Phillips, G., Felix, L., Galli, L., Patel, V., & Edwards, P. (2010). The effectiveness of mHealth technologies for improving health and health services: A systematic review protocol. *BMC Research Notes*, *3*(1), 1–7. https://doi.org/10.1186/1756-0500-3-250

Hilbert, D. D., & Eis, S. D. (2014). Early intervention for emergent literacy development in a collaborative community pre-kindergarten. *Early Childhood Education Journal*, *42*(2), 105–113. https://doi.org/10.1007/s10643-013-0588-3

Holst, A. (2019). Num*ber of smartphone users in South Africa from 2014 to 2023 (in millions).* Retrieved from www.statista.com/statistics/488376/forecast-of-smartphone-users-in-south-africa/

Howie, S. J., Combrinck, C., Roux, K., Tshele, M., Mokoena, G. M., & McLeod Palane, N. (2017a). *PIRLS literacy 2016: Progress in International Reading Literacy Study 2016 South African children's reading literacy achievement*. Pretoria. Retrieved from https://www.up.ac.za/media/shared/164/ZP_Files/pirls-literacy-2016_grade-4_15-dec-2017_low-quality.zp137684.pdf

Howie, S. J., Combrinck, C., Roux, K., Tshele, M., Mokoena, G. M., & McLeod Palane, N. (2017b). *PIRLS literacy 2016: South African highlights report*. Pretoria. Retrieved from https://repository.up.ac.za/bitstream/handle/2263/66185/Combrinck_Pirls_2017.pdf?sequence=1&isAllowed=y

Howie, S. J., van Staden, S., Tshele, M., Dowse, C., & Zimmerman, L. (2012). *PIRLS 2011 Progress in International Reading Literacy Study 2011 South African children's reading literacy achievement*. Pretoria. https://doi.org/10.1016/0032-3950(78)90051-5

Innovation Edge. (2017). *CareUp*. Retrieved April 7, 2018, from http://innovationedge.org.za/project/careup/

Innovation Edge. (2018). *Wordworks: An app that helps support early learning.* Retrieved March 19, 2019, from https://ilifalabantwana.co.za/wordworks-an-app-that-helps-support-early-learning/

Iribarren, S. J., Cato, K., Falzon, L., & Stone, P. W. (2017). What is the economic evidence for mHealth? A systematic review of economic evaluations of mHealth solutions. *Plos One*, *12*(2), 1–21. https://doi.org/10.1371/journal.pone.0170581

Jung, E. (2016). The development of reading skills in kindergarten influence of parental beliefs about school

readiness, family activities, and children's attitudes to school. *International Journal of Early Childhood*, *48*(1), 61–78. https://doi.org/10.1007/s13158-016-0156-2

Lonigan, C. J., Wagner, R. K., Torgesen, J. K., & Rashotte, C. A. (2007). *Test of Preschool Early Literacy*. Austin, TX: Pro-Ed.

Louw, C., Swanepoel, D. W., Eikelboom, R. H., & Myburgh, H. . (2017). Smartphone-based hearing screening at primary health care clinics. *Ear and Hearing*, *38*(2), 93–100. https://doi.org/10.1097/AUD.0000000000000378

Maleka, B. K., van der Linde, J., Glascoe, F. P., & Swanepoel, D. W. (2016). Developmental screening-evaluation of an m-Health version of the Parents Evaluation Developmental Status tools. *Telemedicine Journal and E-Health: The Official Journal of the American Telemedicine Association*, *22*(12), 1013–1018. https://doi.org/https://doi.org/10.1089/tmj.2016.0007

Neumann, M. M., Hood, M., & Neumann, D. L. (2009). The Scaffolding of emergent literacy skills in the home environment: A case study. *Early Childhood Education Journal*, *36*(4), 313–319. https://doi.org/10.1007/s10643-008-0291-y

Nielsen. (2013). *The consumer mobile: A global snapshot*. Retrieved from https://www.nielsen.com/wp-content/uploads/sites/3/2019/04/Mobile-Consumer-Report-2013-1.pdf

Okeyo, A. (2015). *Strengthening foundational literacy: A process and outcome evaluation of the Wordworks Early Literacy Programme*. *Master's dissertation*. University of Cape Town.

Olivier, A., Anthonissen, C., & Southwood, F. (2010). Literacy development of English language learners: The outcomes of an intervention programme in grade R. *The South African Journal of Communication Disorders*, *57*(12), 58–65. https://doi.org/10.7196/sajcd.42

Olivier, J. M. (2009). *Investigating literacy development among learners with a second language as medium of education-The effects of an emergent literacy stimulation program in Grade R. Doctoral thesis*. Stellenbosch University, South Africa.

Owens, R. E. (2014). *Language development: An introduction* (8th ed). London: Pearson Education.

Papadakis, S., Zaranis, N., & Kalogiannakis, M. (2019). Parental involvement and attitudes towards young Greek children's mobile usage. *International Journal of Child-Computer Interaction*. https://doi.org/10.1016/j.ijcci.2019.100144

Paul, R. (2007). Applebee's system for scoring narrative stages. In *Language disorders from infancy through adolescence* (3rd ed.). St Louis, MO: Mosby, Inc.

Paul, R., & Norbury, C. (2012). *Language disorders from infancy through adolescence* (4th ed.). St. Louis, Mo.: Elsevier.

Pearson. (2018). *Mobile technology literacy initiative helps 200,000 families in India*. Retrieved April 11, 2019, from https://www.pearsonlearned.com/an-award-winning-initiative-to-improve-literacy-has-brought-books-to-200000-families/

Raynolds, L. B., López-Velásquez, A., & Olivo Valentín, L. E. (2017). Exploring English and Spanish rhyme awareness and beginning sound segmentation skills in prekindergarten Spanish-speaking English Learners. *Reading and Writing*, *30*(4), 719–737. https://doi.org/10.1007/s11145-016-9696-y

Reese, E., Sparks, A., & Leyva, D. (2010). A review of parent interventions for preschool children's language and emergent literacy. *Journal of Early Childhood Literacy*, *10*(1), 97–117. https://doi.org/10.1177/1468798409356987

Roberts, N., & Spencer-Smith, G. (2017). *An evaluation of the CareUp first design cycle: Aug-Dec 2016*. Soweto. Retrieved from http://www.wordworks.org.za/wp-content/uploads/2018/07/CareUp-Evaluation-Report-Exec-Summary.pdf

Rosenman, S., & Madelaine, A. (2012). Predicting literacy achievement in young English language learners: A question of language proficiency or of learning difficulty? *Australian Journal of Learning Difficulties*, *17*(1), 17–34. https://doi.org/10.1080/19404158.2012.665376

Rowe, M. L., Denmark, N., Harden, J. B., & Stapleton, L. M. (2016). The role of parent education and parenting knowledge in children's language and literacy skills among White, Black, and Latino families. *Infant and Child Development*, *25*(May), 198–220. https://doi.org/10.1002/icd

Rudge, A. (2017). *CareUp*. Cape Town: The reach trust. Retrieved from http://www.bridge.org.za/wp-content/uploads/2017/03/CareUp-Presentation-to-ECD-CoP-2-March-2017.pdf

Rule, P., & Land, S. (2017). Finding the plot in South African reading education. *Reading & Writing*, *8*(1), 1–8. https://doi.org/10.4102/rw.v8i1.121

Sharma, H., Vallabh, P., & van der Merwe, M. (2013). *Emergent literacy skills of English first language speakers in an urban context*. *Master's dissertation*. University of Pretoria.

Shipley, K., & McAfee, J. (2016). *Assessment in Speech-Language Pathology* (5th ed.). Boston: Cengage Learning.

Spaull, N., & Draper, K. (2015). Examining oral reading fluency among rural Grade 5 English second language (ESL) learners in South Africa: An analysis of NEEDU 2013. *South African Journal of Childhood*

Education, *5*(2), 44–77. Retrieved from http://www.scielo.org.za/pdf/sajce/v5n2/04.pdf

Stadler, M., & Ward, G. (2005). Supporting the narrative development of young children. *Early Childhood Education Journal*, *33*(2), 73–80. https://doi.org/10.1007/s10643-005-0024-4

Statistics South Africa. (2011a). *Census 2011: Census in brief*. *Statistics South Africa*. Pretoria. https://doi.org/ISBN 978-0-621-41388-5

Statistics South Africa. (2011b). *City of Tshwane.* Retrieved March 19, 2019, from http://www.statssa.gov.za/?page_id=993&id=city-of-tshwane-municipality

Statistics South Africa. (2017). *Poverty trends in South Africa: An examination of absolute poverty between 2006 and 2015*. *Statistics South Africa*. Pretoria. Retrieved from https://www.statssa.gov.za/publications/Report-03-10-06/Report-03-10-062015.pdf

Stefano, L., O'Carroll, S., & Comrie, B. (2015). *Every word counts: Lessons from a 2015 pilot*. Cape Town. Retrieved from http://www.wordworks.org.za/wp-content/uploads/2017/03/EWC-2015-Lessons-from-pilot.pdf

Surka, S., Edirippulige, S., Steyn, K., Gaziano, T., Puoane, T., & Levitt, N. (2014). Evaluating the use of mobile phone technology to enhance cardiovascular disease screening by community health workers. *International Journal of Medical Informatics*, *83*(9), 648–654. https://doi.org/10.1002/ana.22528.Toll-like

Swanepoel, D. W. (2016). mHealth improves access to community-based hearing care. *The Hearing Journal*, *69*(8), 30–32.

The Reach Trust. (2018). *CareUp*. Retrieved April 7, 2018, from http://www.thereachtrust.org/careup/

Trainin, G., Wessels, S., Nelson, R., & Vadasy, P. (2017). A study of home emergent literacy experiences of young Latino English learners. *Early Childhood Education Journal*, *45*(5), 651–658. https://doi.org/10.1007/s10643-016-0809-7

van der Linde, J. (2016). *Developmental screening and communication delays in infants: A South African primary health care perspective*. *Doctoral thesis*. University of Pretoria.

Vermaak, C. E. (2006). *Phonological awareness skills of a group of Grade 4 learners, in a multi-cultural, multi-lingual education context with English as language of learning and teaching (ELoLT)*. *Master's dissertation*. University of Pretoria.

Wasik, B. A., & Hindman, A. H. (2011). Improving vocabulary and pre-literacy skills of at-risk preschoolers through teacher professional development. *Journal of Educational Psychology*, *103*(2), 455–469. https://doi.org/10.1037/a0023067

Wildschut, Z., Moodley, T., & Aronstam, S. (2016). The baseline assessment of Grade 1 learners' literacy skills in a socio-economically disadvantaged school setting. *South African Journal of Childhood Education*, *6*(1), 1–9.

Willenberg, I. (2007). Foundations for literacy: Emergent literacy competencies of grade R learners on the Cape Flats. *The South African Journal of Communication Disorders*, *54*, 20–28.

Wilson, S. B., & Lonigan, C. J. (2010). Identifying preschool children at risk of later reading difficulties: Evaluation of two emergent literacy screening tools. *Journal of Learning Disabilities*, *43*(1), 62–76. https://doi.org/10.1177/0022219409345007

Wordworks. (2017). *The importance of early education*. Cape Town: Wordworks. Retrieved from http://www.wordworks.org.za/wp-content/uploads/2017/07/Wordworks-CareUp-leaflet-2017_May-update.pdf

Xu, Y., Chin, C., Reed, E., & Hutchinson, C. (2014). The effects of a comprehensive early literacy project on preschoolers' language and literacy skills. *Early Childhood Education Journal*, *42*(5), 295–304. https://doi.org/10.1007/s10643-013-0613-6