Reading & Writing - Journal of the Literacy Association of South Africa
ISSN: (Online) 2308-1422, (Print) 2079-8245

Phonological awareness and speech perception: Skills of Grade 1 English second language learners

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Dates:
Received: 12 Sept. 2019
Accepted: 31 Mar. 2020
Published: 27 May 2020

How to cite this article:
Eslick, C.J., Le Roux, M., Geertsema, S. & Pottas, L., 2020, 'Phonological awareness and speech perception: Skills of Grade 1 English second language learners', *Reading & Writing* 11(1), a263. https://doi.org/10.4102/rw.v11i1.263

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Background: Literacy achievement of learners is a concern in many developing countries, particularly for English second language (EL2) learners with inadequate language development. It is important to investigate foundational phonological awareness (PA), as well as speech perception skills to guide the development of effective intervention for EL2 learners to facilitate optimal literacy acquisition.

Objectives: The study aimed to describe the PA and speech perception in noise skills of South African Grade 1, EL2 participants, learning in an English first language (EL1) context, to inform evidence-based support during literacy acquisition for EL2 learners.

Method: A cross-sectional, descriptive design was employed. Twenty-five EL1 participants provided normative results for the Phonological Awareness Test – 2 and *South African English Digits-in-Noise Test*, enabling between-group comparisons with 25 matched EL2 participants for quantitative data analysis. Demographic and background information was obtained using parental questionnaires.

Results: The EL2 learners presented with PA skills below those of EL1 learners in all subtests. Though the speech perception in noise skills of EL2 learners were within the normative range for their age, their skills are also lower in comparison to EL1 learners.

Conclusion: The findings support the inclusion of explicit PA instruction for rhyming, segmentation, isolation, deletion, substitution, and blending for EL2 literacy acquisition. Developing speech perception in noise skills is necessary to facilitate PA and phoneme-grapheme knowledge. This can enable decoding for early EL2 literacy acquisition.

Keywords: language of instruction; literacy; multilingualism; phonological awareness; second language; speech perception.

Introduction

Oral language proficiency is fundamental to literacy development and academic success (Hay & Fielding-Barnsley 2012:24; Nyaga 2015:175). Worldwide, particularly in developing countries, many young learners have insufficient language proficiency for academic learning, with resultant flat learning trajectories (Taylor & Von Fintel 2016:75; Wildschut, Moodley & Aronstam 2016:2). The learning challenges are particularly distressing in multilingual settings on the African continent, where teaching and language learning frequently occur in languages that differ from the learners' first languages (Howie et al. 2017:19).

Using the first language (L1) as the language of instruction is preferable since second language (L2) learners often have insufficient vocabulary knowledge and Cognitive Academic Language Proficiency (CALP) to learn successfully in the L2 (Webb, Lafon & Pare 2010:284; Wildschut et al. 2016:2). For 65.3% of South African school learners, however, English language of learning and teaching (ELoLT) is preferred. Although English is understood in most urban areas and used as the primary language for governance and journalism, it is the L1 for less than 10% of the general population (Alexander 2018). Many learners, therefore, receive instruction in their L2 (Howie et al. 2012:9; Taylor & Von Fintel 2016:76).

While the complex linguistic landscape of South Africa contributes to the academic challenges faced by learners, insufficient language proficiency is perpetuated by reduced opportunities, limited resources and low quality exposure in the home environment (Alcock, Ngorosho & Matthew 2017:9; Callaghan & Madelaine 2012:13; Howie et al. 2017:17). Few learners, especially from rural areas and low-income families, have books available at home, and few books are available in their first language (Cilliers & Bloch 2018:2). This is a concern as literacy exposure is

understood to support PA development (Alcock et al. 2017:9) and children need to interact with texts to become independent readers (Hay & Fielding-Barnsley 2012:24). Learners with parents who have higher education levels are often approximately six months ahead in literacy development due to expectation differences (Wildschut et al. 2016:2). For developing countries like South Africa, low socio-economic status (SES) and subsequent limited resources may be identified as detrimental to literacy development. A lack of libraries, limited skills of teachers in the LoLT, as well as poor learner-teacher ratios create further barriers to literacy development (Cilliers & Bloch 2018:2; Howie et al. 2012:66).

Literacy development and academic underachievement are of critical concern on the African continent, particularly in South Africa with 78% of Grade 4 learners unable to comprehend text they read (Howie et al. 2017:73). Findings of the Annual National Assessments showed that the underachievement of learners increases over time, a circumstance which necessitates intervention (Wildschut et al. 2016:1).

Recent research on literacy development identified risk factors that require intervention which includes low levels of language proficiency, vocabulary knowledge, working memory, speech perception, and phonological awareness (PA) skills (Alcock et al. 2017:2; Malda, Nel & Van de Vijver 2014:35; Wildschut et al. 2016:1). PA as well as speech perception skills, both of which are predictive of literacy achievement, require access to the phonological structure of speech (Callaghan & Madelaine 2012:14; Goldstein et al. 2017:89).

The phonological structure refers to a hierarchy of phonological complexity that develops through the perception of speech sounds from birth (Webb & Lederberg 2014:131). Early language experience is therefore important, so consequential bilinguals experience challenges in developing appropriate PA in an L2 at school age (Probert & De Vos 2016:1). The developmental sequence of PA is typically described as progressing from metalinguistic awareness of rhyme, to awareness of syllables, and lastly phonemes. The skills required include recognising, discriminating, and manipulating sound units of words (Goldstein et al. 2017:89; Preston & Edwards 2010:45). Rhyming is regarded as a foundational skill of PA (Callaghan & Madelaine 2012:15). However, many EL2 learners in South Africa have reduced exposure to rhyme, as it seldom exists or occurs in African languages (Prof. P.M. Sebate, UNISA, pers. comm., 05 April 2018). Rhyming is regarded as an important supporting skill for listening and auditory memory to develop syllable and phoneme awareness for PA and literacy acquisition (Cassady, Smith & Putman 2008:512; Wildschut et al. 2016:2).

Phonemic awareness skills, particularly phoneme segmentation and phoneme blending, are sophisticated PA skills that should develop during Grade R (age 6 years) and Grade 1 (age 7 years) for literacy acquisition (Callaghan & Madelaine 2012:16; Ouellette & Haley 2013:35). These skills are required for understanding relations between spoken language and orthography, facilitating phoneme-grapheme coupling, known as phonics (Goldstein et al. 2017:89). Orthographic systems of languages influence the development of phoneme-grapheme representations. English, with its opaque orthography, presents difficulties for EL2 learners who are required to master numerous vowel phonemes and many-to-one mappings (Alcock et al. 2017:3; Le Roux et al. 2017:2; Probert & De Vos 2016:1).

Fine-tuned speech perception is a prerequisite to associate phonemes with graphemes and to refine phoneme representations for PA and word reading (Chung et al. 2013:203). Conversely, knowledge of phoneme representations is necessary to perceive and derive meaning from speech sequences (Preston & Edwards 2010:45). It is therefore hypothesised that the processes of PA and speech perception are linked by the internal phonological structure (Chung et al. 2013:204). Speech perception evidently lies at the heart of early literacy development.

The development of PA skills may be delayed in children with normal hearing abilities who present with atypical speech production deficits, weak vocabulary and grammar, or delayed speech perception (Preston & Edwards 2010:45). Speech perception in noise requires adequate phonological working memory, vocabulary, speed of information processing, and inference-making skills which reach optimal development at approximately 15 years of age (Kaandorp et al. 2016:157; Lagace et al. 2011:386). Factors contributing to speech perception difficulties include limited language proficiency, poor auditory development, and a low signal-to-noise ratio (SNR) (Kaandorp et al. 2016:158; Krizman et al. 2017:834).

External noise and room noise disrupt learning and reduce the SNR (Mealings et al. 2015:2; Obralić 2016:53). Large average class sizes of 45 learners in South Africa (Howie et al. 2017:127) increase the distance between teachers and learners, resulting in reverberation that reduces speech intelligibility (Mealings et al. 2015:2). Research demonstrated that Grade 1 learners need a favourable SNR of approximately +15 decibels (dB) to comprehend 95% of an auditory signal (Lewis et al. 2010:761; Mealings et al. 2015:2). With a clear correlation between listening conditions in a classroom and academic achievement (Obralić 2016:55), it is a concern that many educational contexts are not conducive to learning due to unfavourable listening conditions (Lewis et al. 2010:761).

Differences in speech perception are exacerbated under suboptimal conditions (Krizman et al. 2017:835). A lack of access to linguistic cues reduces the comprehension abilities of EL2 learners (Krizman et al. 2017:834). Furthermore, when EL2 learners are expected to read, write, and learn in their L2, their level of language proficiency may decrease their rate of literacy acquisition (Wildschut et al. 2016:7).

Despite the barriers faced by EL2 learners, they are expected to acquire cognitive academic language proficiency (CALP) and develop literacy at the same pace as EL1 learners. While it is acknowledged that much research has been conducted

on various issues relating to literacy, such research mainly emanates from developed countries, and further description of related difficulties such as PA and speech perception in noise is necessary for developing countries where literacy and educational practices differ (Taylor & Von Fintel 2016:76).

Since literacy skill acquisition begins early with PA and speech perception in noise, early support for learners is essential (Callaghan & Madelaine 2012:13; Goldstein et al. 2017:89). The required support, however, is often not available (Cilliers & Bloch 2018:1; Howie et al. 2017:97). It is known that awareness of sounds in a language can be enhanced through providing explicit PA activities during Pre-school and the Foundation Phase (Le Roux et al. 2017:7; Lessing & De Witt 2016:106). Therefore, this study aimed to answer; 'What is the level of EL2 learners' PA and speech perception in noise skills for learning in an EL1 environment?' The study further aimed to shed light on the implications of inadequate skills and to provide information for the support of EL2 literacy development.

Method

Research design

A cross-sectional, descriptive, between-group comparative design was employed. A once-off assessment was required to determine the level of PA and speech perception in noise skills of the participants. As South African normative data is not available for an in-depth PA test, scores of EL1 participants were required to benchmark the level of skills required by EL2 learners to function and acquire literacy in the EL1 classroom. Between-group comparison of participants in two groups (EL2 group and EL1 group) was thus required for quantitative analysis and enabled the researcher to determine and profile the skills of EL2 learners to portray in visual depictions. The descriptive nature of the research, therefore, supported the study aim to describe the level of EL2 learners' PA and speech perception in noise skills.

Participant selection criteria and sampling procedures

Through convenience sampling, two schools were identified from which participants were selected. To minimise differences between participants, the schools were from the same district, used ELoLT, and followed the South African Curriculum Assessment Policy Statement (CAPS) syllabus with a phonics approach to literacy development.

Participants who met the criteria for inclusion in either the EL1 or EL2 group were selected using the non-probability purposive sampling method. English second language participants were selected first, after which matched EL1 participants were identified (from those who provided consent) for valid comparison of skills. Matching occurred according to their age, gender, and parents' estimation of SES, which was determined through parental questionnaires. Socio-economic status was categorised as low (< R5000), middle (between R5000 and R40 000) and high (> R40 000). The participants were selected if they were 6–7 years old and in their first year of formal schooling. To ensure consistency of education and sufficient English CALP, the participants were required to have completed their Grade R year at the same school the previous year. The participants were required to pass both hearing and language screening to ensure the validity of results.

An otoscopic examination was followed by tympanometry. Thereafter, hearing screening was conducted with the *HearScreen*™ application following the 'child protocol' of 25 dB at 1000 Hz, 2000 Hz, and 4000 Hz (Swanepoel et al. 2014:848). The *Kindergarten Language Screening Test – Second Edition* ([*KLST-2*) (Gauthier & Madison 1998) for children age 4–6 years 11 months was used to identify participants with language difference, delay, or disorder to ensure validity of results.

Participant description

Fifty participants were selected from two schools in the Tshwane District, South Africa. The subject group included 25 EL2 participants with a mean age of 79.34 months (3.40 SD). The control group of 25 EL1 participants had a mean age of 79.53 months (3.42 SD). The gender distribution was 60% female in both groups. Twelve per cent of parents in both groups indicated an estimated 'high' SES above R40 000 a month. Sixty per cent of EL1 parents and 52% of EL2 parents indicated a 'middle' SES between R5 000 and R40 000 a month. The EL2 participants spoke an African language as their L1. Setswana (24%) and Northern Sotho (24%) were indicated as the most commonly spoken L1s in the EL2 group. isiZulu (16%) and Tshivenda (12%) also occurred as L1. All EL2 participants received no L1 book reading exposure in their home environment before attending Grade R.

Materials

The *South African English Digits-in-noise Test* (*SA Eng DIN Test)* (Potgieter et al. 2016:410) was accessed via a Samsung SM-G313H Trend Neo Smartphone and Sennheiser HD 202 II headphones, to objectively determine speech perception in noise abilities of participants in the noisy classroom environment. Digits-in-noise (DIN) testing is preferable as pure tone audiometric testing shows a weak relationship between pure tone thresholds and speech perception in noise skills (Smits, Theo Goverts & Festen 2013:1693). An advantage of the *SA Eng DIN Test* is the use of digits as speech material which eliminates potential influences of cognitive aspects such as auditory memory and the linguistic demand through the 'closed-set' (Potgieter et al. 2016:406). Since many languages in South Africa use English digits, the speech material is mostly familiar to both EL1 and EL2 learners (Smits et al. 2013:1694).

To assess PA skills, the following sections of the *Phonological Awareness Test – 2* (*PAT-2*) were used (Robertson & Salter 2007a:11):

- The Phonological Awareness section which includes discriminating and producing rhymes, segmenting sentences, syllables and phonemes, isolating sounds in

initial, final and medial positions, deleting compounds, syllables and phonemes, substitution by manipulating, and blending syllables and phonemes.
- The Phoneme-Grapheme Knowledge section which includes identifying graphemes (letter – sound) and decoding.

A parental questionnaire was used to obtain demographic information and information regarding their estimated SES.

Data collection

Participants were individually assessed at their school. Assessment lasted approximately one hour. The *SA Eng DIN Test* assessed speech perception in noise via automated presentation of digit-triplets through earphones, at a comfortable listening level. Once the response was entered, the proceeding digit-triplet was presented at a level 2 dB higher for a correct answer and 2 dB lower for an incorrect answer. Following the speech perception in noise assessment, instructions for the *PAT-2* (Robertson & Salter 2007a:15) subtests were given as instructed in the examiner's manual to ensure validity of the results. Questionnaires were collected from the parents. Ambiguous or inappropriate answers were re-checked and confirmed through telephonic interviews.

Data analysis and processing

The speech perception in noise scores of participants were automatically generated by the *SA Eng DIN Test* and evaluated according to South African normative data (Methula, Visser & Zulu 2016; Potgieter et al. 2018:661). Scores are presented as the average SNR yielding 50% speech intelligibility (digit-triplets perceived correctly), known as the speech reception threshold (SRT).

To score the *PAT*-2, each participant's total of correct answers were determined for every subtest, sub-section, section and total test score. Using the *PAT-2* statistics manual, participants' raw scores were converted to standardised scores according to age. Due to sample size, means would be easily skewed by outlying results. Thus, medians were calculated and used to allow EL2 and EL1 group comparisons. The *PAT*-2 uses 100 as the mean standardised score and a standard deviation of 15 (Robertson & Salter 2007b:43).

Normative values for the South African EL2 population are not specified in the *PAT-2*. Scores of the EL1 learners in the control group were used to determine an approximate normative measure against which the skills of EL2 learners were compared. The *PAT*-2 therefore indicates level of functioning, and standardised scores are presented as opposed to age equivalents. To facilitate interpretation of the level of skills observed, the percentage of correct responses will also be presented.

Microsoft Excel® Spreadsheets were used to store data. Quantitative data analysis was conducted using IBM SPSS version 23.0 for Windows (IBM Corp., Armonk, N.Y., USA). Descriptive statistics of all data were determined including the mean, standard deviation, median, and interquartile range. Significant differences ($p < 0.05$) between median standardised scores of EL1 and EL2 parametric data were identified with the Wilcoxon Signed Rank Test. Spearman's Rank Order Correlation (rho) investigated potential relationships among variables. A 2-Tailed Significant Difference Test was used to investigate relationships within the groups.

Ethical consideration

The research study was sanctioned by the Research Ethics Committee of the Faculty Humanities at the University of Pretoria (Reference number: GW20170309HS).

Results

The results of the EL1 learners are regarded as a baseline indicator of the expected level of skills necessary for EL2 learners to learn in the EL1 environment.

Overall performance

The scores of EL1 and EL2 participant groups for both the *SA Eng DIN Test* and total *PAT-2* were summarised, including significant differences (Table 1).

The speech perception in noise and PA skills of EL2 learners were both significantly below those of the EL1 learners. Regarding PA skills, the EL2 learners scored below the EL1 learners in both the Phonological Awareness and the Phoneme-Grapheme Knowledge section.

Performance on the SA Eng DIN Test

The speech perception in noise results of the EL1 and EL2 learners obtained via the *SA Eng DIN Test* are depicted according to the median SRT scores calculated (Figure 1).

TABLE 1: *SA Eng DIN Test*, total *PAT-2* and section scores: Percentages, medians and interquartile ranges of English first language and English second language learners.

Variable	EL1 learners			EL2 learners			Difference (months)	*p*-value (< 0.05)
	Correct responses (%)	Median SS	IQR	Correct responses (%)	Median SS	IQR		
SA Eng DIN Test	-	-8.8	-9.8 – -8.0	-	-7.4	-9.0 – -5.6	N/A	0.008†
PAT-2 (SS)	85	117	114.5–120	45	81	71–87	39	< 0.001†
PA Section (SS)	88	114	112–115.5	55	84	74–98	36	< 0.001†
Phoneme- Grapheme Section (SS)	82	117	114.5–123	35	88	79–98	28	< 0.001†

Source: Eslick, C.J., 2018, *Phonological awareness and speech perception in noise: Skills of English second language learners in Grade 1,* Master's dissertation, University of Pretoria, Pretoria, South Africa, 1–138

DIN, Digits-in-noise; EL1, English first language; EL2, English second language; ss, standard score; IQR, Interquartile range; N/A, not applicable.

†, denotes a significant difference between the EL1 and EL2 learners' scores.

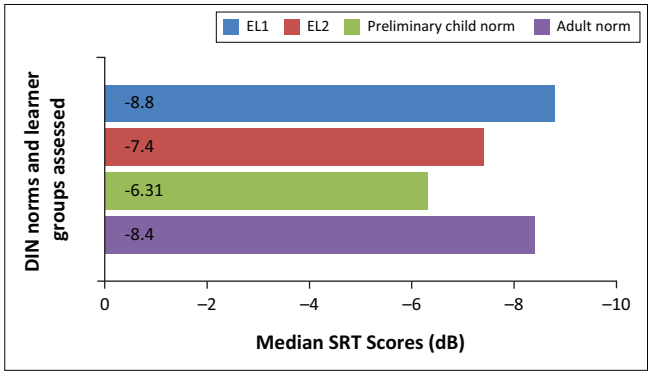
A more negative score indicates a lower SRT and better speech perception in noise skills, as sounds are heard in a higher level of background noise. The median SRT of the EL2 learners was higher than the EL1 learners, indicating a significantly lower ($p = 0.008$) score according to the Wilcoxon Signed Rank Test.

Performance on the Phonological Awareness section of the PAT-2

The correct responses of learners for the Phonological Awareness sub-sections of the *PAT-2* were summarised as percentages (Figure 2).

A difference of more than one standard deviation can be noted between scores of the EL1 and EL2 learners across all Phonological Awareness sub-sections. The percentage of correct answers, medians, interquartile ranges (IQRs), difference in months and the significance of this difference between the EL1 and EL2 learners are recorded in Table 2.

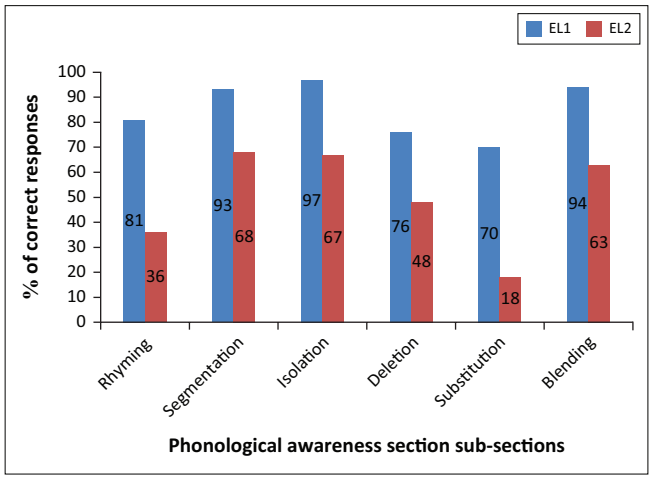
The Wilcoxon Signed Rank Test showed that EL2 group scores differed significantly ($p < 0.001$) from those of the EL1 group across all subtests. For rhyming production, the EL1 group scored a median of 98 whereas more than 50% of the EL2 group scored a median of zero. In the segmentation sub-section, for Segmentation of Sentences, the EL1 and EL2 learners obtained similar percentages of correct answers, however, in Segmentation of Phonemes, 92% of the EL1 learners' answers were correct, whereas, less than half of the EL2 learners' answers were correct.



Source: Eslick, C.J., 2018, *Phonological awareness and speech perception in noise: Skills of English second language learners in Grade 1*, Master's dissertation, University of Pretoria, Pretoria, South Africa, 1–138.

DIN, Digits-in-noise; EL1, English first language; EL2, English second language; dB, decibels; SRT, speech reception threshold.

FIGURE 1: *SA Eng DIN Test:* Speech reception thresholds for the English first language and English second language learners.



Source: Eslick, C.J., 2018, *Phonological awareness and speech perception in noise: Skills of English second language learners in Grade 1*, Master's dissertation, University of Pretoria, Pretoria, South Africa, 1–138

EL1, English first language; EL2, English second language.

FIGURE 2: Sub-sections of the Phonological Awareness section of the *PAT-2*: The percentage of correct responses of English first language and English second language learners.

TABLE 2: Comparison of scores for English first language and English second language learners in sub-sections of the *PAT*-2: Phonological Awareness section.

Variable	EL1 learners			EL2 learners			Difference (months)	*p*-value (< 0.05)
	Correct responses (%)	Median SS	IQR	Correct responses (%)	Median SS	IQR		
Rhyming	**81**	**100**	**92–105**	**36**	**66**	**30–82**	**> 8**	**< 0.001†**
Discrimination	95	110	102–110	56	85	32.5–98	> 6	< 0.001†
Production	67	98	89–103	15	0	0–81.5	> 7	< 0.001†
Segmentation	**93**	**123**	**118.5–125.5**	**68**	**99**	**93–108.5**	**> 48**	**< 0.001†**
Sentences	96	115	115–115	84	108	95–115	> 1	0.003†
Syllables	92	119	113–119	78	107	99–113	> 16	0.007†
Phonemes	92	129	124–129	41	100	95–110	> 45	< 0.001†
Isolation	**97**	**117**	**114–117.5**	**67**	**98**	**83–112**	**> 51**	**< 0.001†**
Initial	99	108	108–108	90	108	102–108	1	0.010†
Final	95	117	112–117	60	103	89–112	> 21	< 0.001†
Medial	98	123	123–123	50	106	0–119	> 34	< 0.001†
Deletion	**76**	**108**	**102–111**	**48**	**87**	**80.5 –100.5**	**17**	**< 0.001†**
Compounds and Syllables	84	109	103–121	63	98	92 –108.5	26	0.004†
Phonemes	69	110	105–115	32	96	0–102.5	12	< 0.001†
Substitution	**70**	**108**	**102–115**	**18**	**0**	**0–97.5**	**> 26**	**< 0.001†**
Blending	**94**	**109**	**104.5–113**	**63**	**79**	**70–94.5**	**27**	**< 0.001†**
Syllables	98	109	109–110.5	84	94	85–106	> 15	< 0.001†
Phonemes	90	111	103.5–112	42	81	65–93.5	32	< 0.001†

Source: Eslick, C.J., 2018, *Phonological awareness and speech perception in noise: Skills of English second language learners in Grade 1*, Master's dissertation, University of Pretoria, Pretoria, South Africa, 1–138

EL1, English first language; EL2, English second language; %, percentage; ss, standard score; IQR, Interquartile range.

†, denotes a significant difference.

The EL1 and EL2 learners both obtained a median score of 108 for the Isolation of Initial Sounds subtest, however, their percentage of correct answers differed significantly. The EL2 learners had 90% of their answers correct in Isolation of Initial Sounds, though this score declined for Isolation of Final Sounds, and Isolation of Medial Sounds.

The EL2 learners scored below the EL1 learners in both deletion subtests with less than half of their answers being correct. The greatest significant difference is shown between the scores of the EL1 and EL2 learners for the substitution sub-section. The EL2 learners' percentage of correct responses in the blending sub-section on the syllable level is close to the percentage of the EL1 learners. On the phoneme level, the percentage of correct answers provided by the EL2 group was less than half of the EL1 group's.

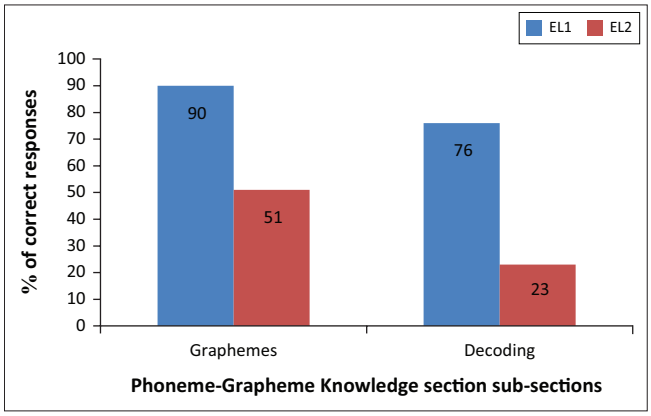
Performance on the Phoneme-Grapheme Knowledge section of the PAT-2

The correct answers for the Graphemes and Decoding sub-sections of the *PAT-2* are depicted as percentages (Figure 3).

Though the *PAT-2* is not validated for EL2 learners, the significant difference ($p < 0.001$) between the EL1 and EL2 group scores for both the Graphemes and Decoding sub-sections is notable as it was almost two standard deviations, which warrants intervention according to the *PAT-2* (Robertson & Salter 2007a:37). The percentage of correct responses, medians, IQRs, difference in months, and the significance of the difference between EL1 and EL2 learners for the Graphemes and Decoding sub-sections were tabulated (Table 3).

In the graphemes sub-section, the EL2 learners' score was significantly below the EL1 learners' score. The median of 83 in the consonants subtest indicates that the EL2 learners most frequently could identify fourteen consonants. The EL2 learners scored a median of zero in four graphemes subtests. The EL2 learners appeared to have difficulty with long or short vowels and vowel digraphs as they provided significantly less correct answers than the EL1 learners. Further analysis identified a strong, positive correlation between the Graphemes and Blending sub-sections (rho = 0.648, $p < 0.001$).

The EL2 group demonstrated decoding abilities at an age level of 27 months below that of the EL1 group. The EL2 learners scored a median of zero in six decoding subtests. The segmentation sub-section showed a medium, positive correlation (rho = 0.435, $p < 0.03$) to the decoding sub-section. A significant, strong, positive correlation (rho = 0.891,



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EL1, English first language; EL2, English second language; %, percentage..

FIGURE 3: Sub-sections of the Phoneme-grapheme Knowledge section of the *PAT-2*: The percentage of correct responses of English first language and English second language learners.

TABLE 3: Comparison of scores for English first language and English second language learners in the sub-sections of the *PAT*-2: Phoneme-Grapheme Knowledge section.

Variable	EL1 learners			EL2 learners			Difference (months)	*p*-value (< 0.05)
	Correct responses (%)	Median SS	IQR	Correct responses (%)	Median SS	IQR		
Graphemes	**90**	**117**	**113.5–121.5**	**51**	**91**	**77.5–100.5**	**34**	**< 0.001†**
Consonants	98	110	103.0–110.0	74	83	76.0–94.0	> 6	< 0.001†
Long or short vowels	94	114	108.0–115.5	62	96	87.0–104.5	> 9	< 0.001†
Consonant Blends	86	113	105.0–113.0	36	91	39.0–100.0	> 12	< 0.001†
Consonant Digraphs	94	112	112.0–112.0	17	0	0–86.5	> 5	< 0.001†
R-controlled vowels	92	123	123.0–126.0	39	90	0–116.0	> 28	< 0.001†
Vowel Digraphs	68	118	109.0–127.5	26	0	0–113.5	> 34	< 0.001†
Diphthongs	70	120	109.0–133.5	24	0	0–114.5	> 27	< 0.001†
Decoding	**76**	**118**	**114.0–122.5**	**23**	**89**	**0–103.5**	**27**	**< 0.001†**
VC words	97	115	115.0–116.0	52	100	0–111.5	> 20	< 0.001†
CVC words	91	119	110.5–119.0	41	99	0–110.5	> 33	< 0.001†
Consonant Digraphs	88	119	113.0–119.0	19	0	0–101.5	> 18	< 0.001†
Consonant Blends	70	115	106.0–115.5	18	0	0–97.0	> 22	< 0.001†
Vowel Digraphs	67	116	109.0–126.5	19	0	0–108.5	> 17	< 0.001†
R-controlled vowels	73	118	114.0–124.0	19	0	0–103.0	> 22	< 0.001†
CVCe words	66	115	107.0–127.0	5	0	0–0	> 21	< 0.001†
Diphthongs	57	119	107.5–126.0	11	0	0–98.0	> 24	< 0.001†

Source: Eslick, C.J., 2018, *Phonological awareness and speech perception in noise: Skills of English second language learners in Grade 1*, Master's dissertation, University of Pretoria, Pretoria, South Africa, 1–138.

EL1, English first language; EL2, English second language; ss, standard score; IQR, Interquartile range; VC, vowel-consonant; CVC, consonant-vowel-consonant; CVCe, consonant-vowel-consonant-ending with 'e'.

†, denotes a significant difference.

$p < 0.001$) was evident between the Graphemes and Decoding sub-sections.

Within-group analysis according to gender

Within-group analysis according to gender indicated no significant differences between the genders within groups for the *SA Eng DIN Test*, as well as the *PAT-2* total test and section scores. The scores of females were, however, consistently higher than that of males.

Between-group analysis according to gender

Between-group analysis of EL1 and EL2 males revealed a significant difference between their scores for the *SA Eng DIN Test* ($p = 0.025$). The EL1 and EL2 female group scores on the *SA Eng DIN Test* ($p = 0.084$) showed no significant difference, as the larger group requires a larger score to be deemed statistically significant. Small sample size resulted in the between-group analysis of SES being deemed unreliable.

Between-group analysis of gender revealed significant differences ($p < 0.001$) between their scores for the *PAT-2* total test, Phonological Awareness and Phoneme-Grapheme Knowledge sections, as well as all *PAT*-2 sub-sections, evidencing a moderate level of internal consistency.

Parental feedback

None of the EL2 group parents indicated providing L1 book reading exposure in the home environment before their child attended Grade R. Six (24%) EL2 parents conduct book reading monthly at home, while the remainder conducts weekly book reading activities. According to parents of the EL1 group, all EL1 learners (100%) receive weekly English book reading exposure.

Discussion

The current study aimed to indicate the level of PA and speech perception in noise skills of Grade 1 EL2 learners required to learn in an ELoLT context. The results showed significantly lower PA and speech perception in noise skills of EL2 learners in comparison to EL1 learners, which is consistent with prior research (Kaandorp et al. 2016:163; Le Roux et al. 2017:7; Potgieter et al. 2016:410). Understanding implications of these results for literacy development is important. The potential implications of the EL2 learners' level of skills are highlighted in the following discussion.

Speech perception in noise

In the speech perception in noise results, the EL1 group median SRT is better than the pass or refer SRT (-8.4 dB) of adults with binaural normal hearing in the *SA Eng DIN Test* (Potgieter et al. 2016:409). As the *SA Eng DIN Test* preliminary normative SRT for children age 5–6 years 11 months is between -7.75 dB and -6.31 dB (Methula et al. 2016), the median SRT of the EL2 participants was age appropriate. Although scoring within the normative range for children noted above, the 1.4 dB lower DIN perception of the EL2 participants in this study is significant and corresponds to the 1.7 dB identified in recent research (Potgieter et al. 2018:660). The difference between DIN perception scores of this study differ from prior sentence-in-noise perception results (Kaandorp et al. 2016:166). The closed set of digits limits number of speech sounds, thereby reducing the linguistic demand (Potgieter et al. 2016:406). Additionally, many African languages use English digits, and learners count with English digits in Grade R, which increases familiarity and further reduces linguistic demand (Department of Basic Education 2011:22; Potgieter et al. 2018:657).

The results therefore support the notion that EL2 learners require a higher SNR to benefit from linguistic information, placing them at a long-term disadvantage in their learning environment (Lagace et al. 2011:386; Potgieter et al. 2018:657). Reducing class sizes, closing doors and windows or hanging curtains may enhance speech perception and in that way boost academic achievement (Howie et al. 2017:174; Mealings et al. 2015:2; Obralić 2016:55).

Phonological awareness

The reduced speech perception in noise skills of the EL2 learners may contribute to their reduced Phonological Awareness sub-section score, which is significantly below that of the EL1 learners for all subtests. This significant difference is a concern as PA is the strongest predictor of literacy success (Webb & Lederberg 2014:132).

Rhyming is regarded as a foundational PA skill (Callaghan & Madelaine 2012:15), therefore it is a concern that EL2 learners in this study had difficulty with rhyming. For rhyming production, more than 50% of EL2 learners scored a median of zero for rhyme production, which is consistent with results from another research study (Willenberg 2007:24). Limited rhyming exposure and reduced speech perception in noise skills may contribute to rhyming difficulties of EL2 learners (Prof. P.M. Sebate, UNISA, pers. comm., 05 April 2018). These findings support the notion of teaching rhyme awareness and production in PA, and offering literacy development programmes to provide opportunities for EL2 learners to develop rhyming skills (Hay & Fielding-Barnsley 2012:25; Lessing & De Witt 2016:113; Wildschut et al. 2016:8).

The relatively high level of skills demonstrated by the EL2 learners in segmentation may be attributed to formal PA skill instruction provided in Grade R (Department of Basic Education 2011:24). There was, however, a difference of 48 months between the EL1 and EL2 participant age scores, which is supported by prior research (Le Roux et al. 2017:4). The correct responses of EL2 learners decline from sentence segmentation, to syllable segmentation, and further to phoneme segmentation. The results provide evidence that to be effective, intervention should follow the PA hierarchy, developing awareness from larger units to phonemes (Cassady et al. 2008:512). The percentage of correct responses of the EL2 participants in the phoneme segmentation subtest

was less than half of those provided by the EL1 participants. This may be attributed to the focus on developing syllable awareness as opposed to phoneme awareness in the early school years (Alcock et al. 2017:9). The low phoneme segmentation score of the EL2 participants is a concern as awareness of phonemes supports development of phoneme-grapheme knowledge and is probably more closely related to literacy development than sentence and syllable segmentation (Callaghan & Madelaine 2012:14; Cassady et al. 2008:512).

In the isolation sub-section, the level of skills of the EL2 learners gradually decreased when the subtest stimuli changed from the initial position in words to the final position, and further when the stimuli focussed on the medial position in words. In congruence with prior research, this study affirms that position within the word changes the salience of sounds for EL2 learners, and is a crucial influence to difficulty within the same PA task that may be done in the classroom (Cassady et al. 2008:512; Willenberg 2007:24).

During classroom PA activities, explicit instruction to learn the skill of deletion may be necessary as the EL2 group had equal difficulty with both deletion subtests, which implies that their difficulty may relate to poor understanding of deletion rather than reduced phoneme-grapheme knowledge. Additionally, many EL2 learners did not understand the segmentation task, therefore the low score of the EL2 group is potentially due to lack of exposure to this kind of activity in the home and classroom environment (Department of Basic Education 2011:24; Howie et al. 2017:176). The results support findings that show that EL2 learners have greater difficulty with phonemic awareness tasks for explicit phoneme manipulation compared to forced judgement choices such as rhyme discrimination (Willenberg 2007:26).

The blending score of the EL2 learners was at an age level 27 months below that of the EL1 learners, which raises concern. Although the difference between the EL1 and EL2 learners is less in the blending sub-section compared to the segmentation sub-section, in contrast with prior research, the EL2 group have a lower level of blending skills than segmentation skills (Le Roux et al. 2017:7; Ouellette & Haley 2013:35). According to the findings of this study, the blending skills of the EL2 learners on the syllable level is nearly sufficient, however, not at the phoneme level. As phoneme blending facilitates awareness of phoneme-grapheme coupling for literacy (Ouellette & Haley 2013:38), it is a concern that the correct answers from the EL2 group was less than half of the EL1 group.

Phoneme-grapheme knowledge

Further investigation relating to PA skills of the EL2 participants provided information regarding various aspects of their phoneme-grapheme knowledge and decoding skills. In the graphemes sub-section, the EL2 group age score was 34 months behind the score for the EL1 group. As formal phoneme-grapheme instruction commences in Grade 1 (Department of Basic Education 2011:24), reduced previous exposure is a possible explanation for the low score of the EL2 participants which makes phonemic awareness development difficult (Ouellette & Haley 2013:38). In agreement with findings in a previous study, the EL2 participants most frequently could identify fourteen consonants (Willenberg 2007:24).

The EL2 learners experienced difficulty with graphemes for vowels, particularly vowel digraphs. Their difficulty may be attributed to less sophisticated skills for discriminating phonemes due to the reduced number of vowels in African languages and difference in the phonological structure between English and African languages such as Setswana (Le Roux et al. 2017:2; Malda et al. 2014:35; Probert & De Vos 2016:2). The strong, positive correlation between the Graphemes and Blending indicates that EL2 learners' poor phoneme-grapheme knowledge may contribute to their blending difficulties (Ouellette & Haley 2013:35).

Decoding

Despite the use of non-words, which reduce the impact of vocabulary knowledge on results, the EL2 learners' decoding abilities were shown to be 27 months behind those of the EL1 learners. The results of the decoding sub-section therefore contribute to findings that show that learners with poor PA skills are at risk for literacy difficulties (Preston & Edwards 2010:44). The correlation between segmentation and decoding sub-sections indicates that segmenting skills support decoding skills through developing awareness of syllables and sounds. The strong correlation between Graphemes and Decoding is supported by the relation of the EL2 learners' median score of zero in the decoding subtests which contain graphemes they found difficult (consonant digraphs, consonant blends, vowel digraphs, R-controlled vowels, CVCV words and diphthongs). When evaluating the subtests where the EL2 learners obtained a median of zero, it appears that the EL2 learners had difficulty drawing on their insufficient phoneme-grapheme knowledge to decode words, particularly when adjacent phonemes change sounds in words (Cassady et al. 2008:515; Krizman et al. 2017:840).

In the decoding subtests the EL2 group were unable to generalise their limited PA and phoneme-grapheme knowledge to use blending and to decode nonsense syllables. With English being an opaque language, the EL2 learners appeared to have difficulty with the many-to-one mappings of the syllables presented (Alcock et al. 2017:3; Probert & De Vos 2016:2). It may be speculated that the EL2 learners learnt their phoneme-grapheme correspondences through memorisation as opposed to understanding relations between letters and sounds (Alcock et al. 2017:3; Goldstein et al. 2017:99). A further concern is that their poor level of PA skills may promote reliance on memorisation of phoneme-grapheme representations and little generalisation of skills for literacy (Goldstein et al. 2017:99).

The language learning context may exacerbate the difficulties EL2 learners experience in acquiring the necessary emergent literacy and language skills for literacy acquisition. English

second language learners need to receive sufficient language stimulation and literacy exposure in the home environment (Alcock et al. 2017:3; Hay & Fielding-Barnsley 2012:24; Lessing & De Witt 2016:106). From parents' responses it is evident that the EL2 learners received less frequent exposure to book reading than in the case of EL1 learners. Reduced exposure to books reduces opportunities to engage phoneme-grapheme coupling skills and may extenuate reliance on print as opposed to decontextualised language and word play for literacy (Goldstein et al. 2017:99; Snyman 2016:8 Willenberg 2007:26). Limited literacy experience therefore may contribute to the lower decoding skills and overall poorer phonemic awareness skills of the EL2 learners. Providing a language and literacy home programme with PA, speech perception and decontextualised language tasks may serve to equip parents to support engagement with literacy activities in the home environment (Lessing & De Witt 2016:113; Snyman 2016:8; Willenberg 2007:26).

Conclusion

The overall PA and speech perception in noise skills of EL2 learners are insufficient to acquire literacy at the same level as and at an equal pace to the EL1 learners. The results emphasise the educational significance of the investigation and provide ample evidence that supporting EL2 literacy development in the Foundation Phase is to be regarded as essential.

Though speech perception in noise, phoneme-grapheme knowledge, and PA skills for literacy acquisition were assessed, future research may benefit from inclusion of constructs such as working memory, rapid automatised naming and listening comprehension. The fact that the educational setting was urban, despite being resource limited, reduces the ability to generalise the research findings to the broader educational setting in South Africa. Assessment in the L1 of EL2 learners was not possible due to a lack of standardised tests in African languages. The need to develop standardised tests with normative data for the South African population is also highlighted, as without this information it is difficult to determine objectively which EL2 learners are at a greater risk for delayed literacy development.

Going forward, the development of a multidisciplinary team-based perspective to implement recommendations will be vital. Findings of this study highlight that support for EL2 learners should include efforts to improve the SNR in classrooms and reduce the linguistic demand to facilitate comprehension for EL2 learners (Mealings et al. 2015:15; Obralić 2016:55). While working on PA tasks, the linguistic complexity, task difficulty, and position of sounds in words should be considered and scaffolded according to the level of understanding of EL2 learners (Callaghan & Madelaine 2012:14; Cassady et al. 2008:512). Integrated PA skills training with explicit instruction for phoneme-grapheme coupling (particularly vowel phonemes), is strongly recommended and has been verified by research to effectively improve literacy skills of all learners in a classroom (Le Roux et al. 2017:7; Lessing & De Witt 2016:113; Malda et al. 2014:44). Promotion of literacy development should be a key consideration in all education programmes (Cilliers & Bloch 2018:1). Research has shown that PA, speech perception, and decontextualised language tasks should be included in language and literacy home programmes, which may equip parents to develop their knowledge and support learners (Lessing & De Witt 2016:113; Willenberg 2007:26).

Creating equitable opportunities for EL2 literacy development poses a complex challenge. Support is required for EL2 learners who are already in the education system, who are experiencing a learning gap, with their decreased level of skills, as shown in the results of this study. There is also a need to begin new conversations about the education system to improve learning environments for future EL2 learners. Without adequate attention to the differences between learners regarding skills for literacy acquisition, the disadvantages EL2 learners face are likely to perpetuate the literacy and academic underachievement of South African learners. Supporting literacy skill development of EL2 learners is therefore a crucial goal in education.

Acknowledgements

Competing interests

The authors have declared that no competing interest exists.

Authors' contributions

All authors contributed equally to this work.

Funding information

This research received no specific grant from any funding agency in the public, commercial or not-for-profit sectors.

Data availability statement

Data sharing is not applicable to this article as no new data were created or analysed in this study.

Disclaimer

The views and opinions expressed in this article are those of the authors and do not necessarily reflect the official policy or position of any affiliated agency of the authors.

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