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WHO Collaborating Centre for Prevention of Deafness and Hearing Loss

Correlations of auditory discrimination, phonemic awareness and literacy: evidence from a Grade 4 classroom in rural Gauteng

An article format research project in fulfilment of the requirements for the degree BA: Speech-Language Pathology

Module: KMP 481

Students:

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Supervisors:

Prof M. Le Roux

Prof S. Geertsema

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Letter of adapted format

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Department of Speech-Language Pathology and Audiology

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WHO Collaborating Centre for Prevention of Deafness and Hearing Loss

8 October 2025

Examiner/s: KMP481

Adapted format of article submission KMP481

Dear External Examiner

As supervisors, we have instructed our KMP 481 groups to slightly adapt their KMP 481 article submissions to suit the journals to which they are submitting. *Please note that we did not follow the APA 7th format as indicated in the study guide, but rather the Harvard format (and subsequent in-house styles of Harvard for the respective journals).* The students provided a brief summary of the journals' author guidelines, immediately preceding the embedded article. As we have submitted the articles to these journals (please refer to the submission details), we apologise if this causes any inconvenience. We discussed this change with Prof. De Wet Swanepoel, the module coordinator.

Thank you for understanding and acknowledging this instructed adaptation.

Kind regards

Professors Salomé Geertsema and Mia le Roux

Supervisors: KMP481

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Proof of submission from The Independent Journal of Teaching and Learning

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Submission of manuscript to the Independent Journal of Teaching and Learning

Brenda Van Wyk <Bvanwyk@ilo.ac.za> 7 October 2025 at 10:29
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Good day

The Editorial Committee has been looking into the status of this article, that was submitted outside of the system. We ask that you give us some time to revert, as we are currently inundated with publishing our second issue.

As the journal only has 2 issues per year, your article will only be appearing in one of our two issues of 2026, still depending on the reviewer outcomes.

We will be in contact with you shortly
Best wishes

Dr. Brenda Van Wyk

Managing Editor: The Independent Journal of Teaching and Learning

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From: Mia Le Roux <mia.leroux@up.ac.za>
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Declaration of originality/plagiarism

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Degree/Qualification: BA Speech-Language Pathology

Title of thesis/ dissertation/ mini dissertation: **Auditory discrimination, phonemic awareness and literacy: a correlational study in a Grade 4 English second language classroom**

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Abbreviations

English first language learners: EL1

English second language learners: EL2

First language: L1

Language of Learning and Teaching: LoLT

Phonemic Awareness: PhA

Phonological Awareness: PA

Second Language: L2

The Independent Journal of Teaching and Learning: Author Guidelines

Referencing style:	Harvard
Font and font size:	Times New Roman, font size 11.5
Line spacing:	1.15 line spacing
Total words (excluding tables, figures and references):	6000 words
Title page:	Author names, institutional affiliations and ORCIDs (where possible) of all authors
Abstract:	up to 150 words
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Title page with author information

Correlations of auditory discrimination, phonemic awareness and literacy: evidence from a Grade 4 classroom in rural Gauteng

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Abstract

Auditory discrimination is integral in developing phonological awareness (PA), a metalinguistic skill required for language and literacy acquisition. This study investigates associations between auditory discrimination, segmenting and blending skills, and literacy outcomes such as reading speed and spelling accuracy in Grade 4 learners who transitioned from Setswana instruction to English as the language of learning and teaching (LoLT). A quantitative, retrospective, descriptive, and correlational design was used. The results indicated significant positive correlations between auditory discrimination skills and literacy skills. A strong positive correlation was found between auditory discrimination, spelling skills ($r_s = 0.500$, $p < 0.001$), and reading speed ($r_s = 0.448$, $p < 0.001$). Unlike prior studies, blending and segmentation skills were above age-appropriate levels for English, yet PA skills did not consistently correspond with well-established literacy skills. These outcomes are attributed to differences in phonology and orthographies, limited English exposure, and challenges of transitioning to a new LoLT without explicit support.

Key words

Auditory discrimination; phonological awareness; literacy skills; orthographies; correlations

Article

Introduction

Auditory discrimination refers to the ability to differentiate between similar-sounding phonemes and words (Couvee et al., 2022:311; Weiner, 1967:19). According to Studdert-Kennedy (2002:5), deficits in auditory discrimination result in poor phonological representations of phonemes. Auditory discrimination thus plays an integral role in the development of phonological awareness (PA) (Couvee et al., 2022:311; Corriveau, Goswami & Thomson, 2010:370; Eccles et al., 2021:383-384; Janssen et al., 2016:2). Children who find it challenging to discriminate phonemes, consequently, may struggle to acquire sufficient PA skills and may have difficulty with future language and literacy acquisition (Schaadt, Pannekamp & Van der Meer, 2013:2179-2180; Tallal, 1980, pp. 184-185).

PA is an oral language skill (Hipfner-Boucher et al., 2014:179; Wagner & Torgesen, 1987:192). It encompasses the intentional use and modifications of sounds and sound structures within a language, with the possibility of producing new words whilst drawing on the available phonological knowledge across languages (Giazitzidou et al., 2023:2622). Therefore, PA is a metalinguistic skill that incorporates various phonological skills developing on a continuum (Clauss, 2023:11; Schuele & Boudreau, 2008:5). Over time, the skills intensify in complexity from the least to the most sophisticated (Hodgins & Harrison, 2021:2).

According to the PA hierarchy, sound awareness develops from large to smaller units (Schaadt et al., 2013:2179; Snowling & Hulme, 1994:23), thus following a top-down approach. Initially, PA is acquired on the most basic level known as word awareness (Anthony & Lonigan, 2004:44; Kenner et al., 2017:1578). The simplest skills, including rhyme and syllable awareness, form the basis for more complex PA skills to develop in the future (Bernthal, Bankson & Flipsen,

2017:303; Geudens, 2006:28). As the hierarchy progresses and the chronological age increases, awareness of onset-rime and skills at phonemic levels are achieved (Carroll et al., 2003:913; Zoubrinetzky et al., 2016:3).

The most sophisticated PA skills are phonemic awareness (PhA) (Mohammed, 2014:3), which has an essential impact on the development of literacy skills (Hodgins & Harrison, 2021:2; Siregar, Khairani & Lubis, 2023:6; Stanovich, 1986:363). PhA refers to the ability to recognise phonemes from oral language to manipulate sound structures for new word formations (Cunningham, 1990:429; Eccles et al., 2021:387). Initial PhA includes skills such as identifying the initial sound, and segmenting and blending sounds into a cohesive and meaningful unit (Clauss, 2023:11). A study by Dykstra (1966) indicated that deficits in segmenting and blending skills were associated with poor auditory discrimination skills (Drosos et al., 2024:13). Advanced PhA skills imply that the child requires a deeper level of understanding of PA structures (Schuele & Boudreau, 2008:5) and include segmenting words into constituent phonemes, which indicates an individual's experience that each phoneme in isolation is unique (Cisero & Royer, 1995:276; Rokhman, Lintangsari & Perdhani, 2020:136). Additionally, the deletion of a sound within a word and replacing it with another phoneme are essential skills that form part of PhA (Carruth & Bustos, 2019:56). Auditory discrimination skills contribute towards the development of PhA skills (Janssen et al., 2016:2) by facilitating the awareness that changing a sound alters the pronunciation and word meaning (Clauss, 2023:10-12).

Studies have indicated that there are strong correlations between phoneme awareness and phoneme identification (Zoubrinetzky et al., 2016:3). PhA, therefore, allows children to decode words into phonemes, thus, facilitating reading (De Witt & Lessing, 2016:106; Siregar et al., 2023:6). PhA also facilitates phoneme-grapheme correspondence (Eslick et al., 2020:2; Goswami & Bryant, 1990:2), which is essential to the development of literacy skills (Alshaboul et al., 2014:100; Griffith, 1991:216; Hattingh, 2004:1; Manten et al., 2020:142,143) since children need to be able to match phonemes to the correct grapheme to read and spell successfully (Le Roux et al., 2017:1; Schuele & Boudreau, 2008:6).

Auditory discrimination forms the foundation for the development of phoneme-grapheme correspondence and consequently future reading speed and spelling accuracy (Johann, Könen & Karbach, 2020:324-325; Ouellette, Martin-Chang & Rossi, 2017:350; Snowling & Hulme, 1994:25). Wheeler and Wheeler already established in 1954 that auditory discrimination is strongly correlated with reading success indicating the sequential development of auditory discrimination, PhA and reading skills in the first language (L1) and second language (L2) (Dykstra, 1966:12; Le Roux et al., 2017:2; Schuele & Boudreau, 2008:3).

The sensitivity of the PA and PhA skills of a child will depend on the complexity of their L1 since they are exposed to the sound structure of their L1 from birth (Bassetti et al., 2020:1221; Hattingh, 2004:9-10; Le Roux et al., 2017:2). The discrimination of sounds is facilitated by the sound structure of the individual's L1 (Guzek & Iwanicka-Pronicka, 2023). A study by Krenca et al. (2019) provided evidence of the linguistic interdependence hypothesis, stating that the development of PA in the L1 forms the foundation for the development of PA in the L2. The successful transfer of PA and PhA skills from the L1 to the L2 for academic purposes is contingent upon having well-established comprehension, use, and competence in the L1 (Chung

Chen & Geva, 2019:150; Krenca et al., 2019:21). Therefore, children with poor L1 skills often lack the language ability necessary for academic learning in the L2, which leads to flat learning trajectories (Taylor & Von Fintel, 2016:75; Wildschut, Moodley & Aronstam 2016:2). Having insufficient oral skills in their L1 – including PA skills – may result in an inability to transfer language skills to the L2. This may include a failure to discriminate between sounds in their L2 (Janssen et al., 2016:2). Learning in an L2 may be challenging. This is true especially in South Africa since only 8.7% of the population speaks the language of learning and teaching (LoLT), predominantly English (Statistics SA, 2022:22; Howie et al., 2017:19).

Many South African children are taught in their L1 until the end of Grade 3, after which they are expected to transfer to L2 instruction at the beginning of Grade 4. These learners are English second language learners (EL2) but are expected to function at the same level as English first language learners (EL1) (Sibanda, 2017:2). EL2 learners may potentially find mastering PhA skills challenging due to poor L1 skills (Roux, Van Staden & Tshele, 2023:32) and consequently, literacy development may be compromised (Eslick et al., 2020:8). This phenomenon can be illustrated by EL2 learners in South Africa who have had little exposure to rhyme since it is uncommon or non-existent in African languages according to Prof P. M. Sebate at UNISA (Manten et al., 2020:144). Rhyme identification depends on adequate auditory discrimination skills (Abdusalimovna, 2024:121). It is a crucial skill for developing PhA (Máčajová, Grofčíková & Zajacova, 2019:70) since rhyme awareness stimulates the development of more advanced PA skills. PhA skills improve reading skills in general (Goswami & Bryant, 1990:26; Grofčíková & Máčajová, 2021:132), thus insufficient skills on the phoneme level contribute to the lack of literacy success (Rokhman et al., 2020:136).

Researchers have determined that foundation phase EL2 learners' PA and PhA skills are substantially lower than those of EL1 learners (Kaandorp et al., 2016:163; Le Roux et al., 2017:7; Potgieter et al., 2016:410; Von Hagen, Cohnen & Stadie, 2021:479). The differences in phoneme inventories – especially those of the vowels – and the syllabic structures of the African languages and English may also contribute to lower levels of PhA skills and phonics in EL2 learners (De Sousa, Greenop & Fry, 2010:528; Le Roux et al., 2017:7). The vowel inventories of the African languages usually comprise five to seven vowel phonemes, with an open syllabic system, meaning all syllables end on a vowel (Le Roux et al., 2017:1-2; Ziervogel, 1967) while South African English has an extensive vowel phoneme inventory of 19 to 20 phonemes (Bekker, 2009; Miller, 2019:2). The English syllabic system allows for both open and closed syllables, meaning that syllables can end on vowels or consonants (Hilte & Reitsma, 2011:34; Shahid & Mahmood, 2022:185,186). English also has different phonological rules that govern the combination of consonants in consonant clusters. Consonant clusters in the African languages usually comprise a plosive followed by a fricative, for example /ts/, while in English, clusters can consist of a combination of various sounds, such as fricatives followed by a plosive, for instance/sp/, which do not occur in the African languages (Ziervogel, 1967). The differences in phoneme inventories may be responsible for insufficient auditory recognition skills in the LoLT and may affect the EL2 learners' PA and PhA skills development. (Le Roux et al., 2017:2; Seeff-Gabriel, 2003:305).

The lower levels of PA and PhA skills affect later literacy acquisition (Aysel & Sevilay, 2022:2; Bradley & Bryant, 1983:419-421). In an earlier study, Peregoy and Boyle (2000:241) observed

that a strong foundation in reading abilities in L1 is necessary to acquire reading skills in an L2. According to the Progress in International Reading Literacy Study (PIRLS) of 2021, EL2 learners who were tested in their L1 scored significantly below children tested in Afrikaans or English (Roux et al., 2023:25). Grade 4 EL2 learners often lack the foundational reading skills in their L1 that would be essential for acquiring reading proficiency in their L2 (Pretorius, 2014:54). In addition to other probable reasons for the low scores of the South African participants, EL2 learners in rural communities may not have the necessary print resources in either their L1 or the LoLT (Roux et al., 2023:75). This may impact their acquisition of the necessary PA and PhA skills, affecting literacy development negatively (Eslick et al., 2020:1; Roux et al., 2023:73).

The PIRLS framework identified the purpose of academic reading as information retrieval and literary experience (Van der Berg et al., 2022:52). Eighty-one per cent of Grade 4 learners participating in the PIRLS 2021 study could not read with comprehension (Roux et al., 2023:31). The PIRLS 2021 results indicate that South Africa has lost all progress made in the past decade with a score identical to that of the results from 2011 (Roux et al., 2023:31), placing South Africa approximately seven years behind the best-performing nations (Howie et al., 2017:11; Roux et al., 2023:24). Studies such as De Sousa, 2011; Eslick et al., 2020; Le Roux et al., 2017 and Manten et al., 2020 focusing on the literacy skills of EL2 learners found that the lower PA and PhA skills correlate with the lower literacy skills of the research populations.

The areas of auditory discrimination, PhA, and literacy in the L1 and L2 populations remain challenging in the multilingual global contexts. Limited research on the influence of auditory discrimination on PhA and literacy skill development has been done in South Africa. Adding specific and detailed studies to the existing data corpus may support and inform instructional and teaching plans. As such, the dual-posited research questions are:

(1) What is the correlation between auditory discrimination and the PhA skills of segmenting and blending of Grade 4 learners who have recently transitioned from L1 instruction in Setswana to English as their LoLT, having only been exposed to English as an additional language for the first three years of schooling?
(2) What are possible correlations between auditory discrimination, reading speed and spelling skills in this group?

The null hypothesis (Ho) stated that no statistically significant correlation would be found between auditory discrimination and the PhA skills of segmenting and blending of Grade 4 learners who have recently transitioned from L1 instruction in Setswana to English as their LoLT, having only been exposed to English as an additional language for the first three years of schooling. The alternative hypothesis (Ha) proposed that a statistically significant correlation will exist between auditory discrimination and the PhA skills of segmenting and blending in this group.

Methodology

Aims

Main aim:

The main aim was to investigate correlations between the PhA skills of segmenting and blending and the auditory discrimination skills of Grade 4 learners who recently transferred from Setswana L1 instruction to English as LoLT.

Sub-aim:

The sub-aim was to investigate correlations between auditory discrimination and reading speed and spelling skills of English L2 participants in this group.

Objectives

The objectives were:

- To determine the average age-equivalent auditory discrimination skills scores of the participants.
- To determine the average age-equivalent skills scores of syllable and phoneme blending and segmenting.
- To determine the average age-equivalent skills scores of reading speed and spelling skills.
- To investigate any correlations between the average of the auditory discrimination skills and the average scores of syllable and phoneme blending and segmenting skills.
- To investigate correlations between the average auditory discrimination skills and reading speed and spelling skills.

Research Design

A quantitative, retrospective, descriptive, and correlational study design was employed. The quantitative aspect informed the process of collecting and analysing data using numerical values and measurable variables to determine whether any patterns exist (Ahmad et al., 2019). Additionally, incorporating a correlational study allowed the researchers to measure and compare two or more variables within the collected data to determine whether a relationship exists (Taherdoost, 2022:58).

Participant information and sampling

The participants were 83 Grade 4 learners who recently transitioned from instruction in their L1 (Setswana) to English as their primary LoLT. The selected participants are from a primary school in a rural area in Gauteng.

The inclusion criteria for this study were that all participants speak Setswana as their L1, were taught in Setswana until the end of Grade 3, and thereafter in English. Participants were screened

before selection to identify those with possible hearing difficulties. The screening was done by the speech-language therapists (SLT), collecting the data using the HearZa Application (De Sousa et al., 2018). No participants with hearing difficulties were identified. Any potential participants with cognitive impairments and/or language disorders, as determined by the school, were examined to consider exclusion based on prior assessments done by the school. Again, no such participants were identified.

Data collection procedure

Before the commencement of the current retrospective study and data collection, consent was obtained from the Faculty of Humanities (HUM039/0720) and the Department of Speech-Language Pathology and Audiology (Appendix A and B) at the University of Pretoria. The Gauteng Department of Education also granted permission to conduct the study (Appendix C). Consent was received from the principal (Appendix D) and the parents/caregivers (Appendix E). Assent was obtained from the participants (Appendix F). Non-probability, convenience sampling was used for this study. The data were collected early in the school year during a single week by final-year SLT students, postgraduate students, and researchers who are qualified SLTs. Various standardised early literacy and literacy assessment tools were utilised. The assessment took place in a quiet venue at the school and took approximately one hour per participant, including short rest periods. The results were initially stored in a paper-based format and were then converted to a secure digital format using alphanumeric coding of the participants' data on an Excel Spreadsheet.

Materials

EL2 learners who transition from first-language instruction at the end of Grade 3 to English as the medium of instruction in Grade 4 are seen as on par with their English L1 peers (Schaffler, Nel & Booysen, 2021:562). Therefore, standardised, formally published tools (Leedy & Ormrod, 2015) have been used to ensure reliability and validity. Various standardised assessment materials collected data on the participants' early and later literacy skills.

Assessment 1: The One-Minute Reading Test (Transvaal Education Department, 1987). This test was used to assess the reading speed of deictic sight words. The test contains one-syllable words ranging from two to four letters. The One-Minute Reading Test is standardised for learners aged 6:0 to 16:0.

Assessment 2: The Schonell standardised spelling test (Schonell & Schonell, 1971). This test measured the learners' spelling ability by determining a norm-based age equivalent of their spelling skills. The words are organised according to the sequence followed by most spelling programs, wherein similarly spelt and sounding words are placed together. The Schonell spelling test can be used with participants aged 5:0 to 15:0 and takes approximately 15 minutes to administer.

Assessment 3: The Phonological Awareness Screening Test *(PAST)* (Kilpatrick, 2018) was used to assess the PhA skills of syllable and phoneme blending and syllable and phoneme segmentation.

Assessment 4: The Test of Auditory Processing Skills Third Edition (*TAPS-3*) (Martin & Brownell, 2005) evaluates how well children and adolescents understand auditory stimuli. This test is standardised for learners aged 4:0 to 18:0 years. The Auditory Discrimination subtest was used.

Data analysis

The data were imported into the Statistical Package for the Social Sciences (SPSS) version 29 for data analysis. Results were determined according to the measurements/scales set out in each standardised assessment mentioned in the previous section. The participants' raw scores for each tool were then recorded, used to determine their performance, and compared to the normative data of each assessment tool. The results were analysed statistically by determining the scores of each test and sub-test. The scores were then compared against the norms of the various instruments. The continuous data was tested for normality using the Shapiro-Wilk test. Since the p-values were not greater than 0.05, the data were non-normal and, accordingly, the nonparametric Spearman correlation (r_s) was employed for further data analysis. A p-value of less than or equal to 0.05 was considered statistically significant. The nonparametric Spearman correlation was used to test for statistically significant correlations. The G*Power software (Faul et al., 2007:175) was used to determine the minimum sample size requirement for a statistical power of at least 0.8 when the significance level is 5%. For correlations, the minimum requirement is 84 observations; however, with 83 respondents, the obtained power equalled 0.796, which is close to the desired statistical power of at least 0.8, indicating that the sample size is sufficient.

Reliability and Validity

It is essential to guarantee reliability and validity to ensure the findings are trustworthy, precise, and verifiable (Komelabbas, 2019:94). Reliability and validity were ensured by limiting both visual and auditory distractions whilst administering the tests (Horne, 2020:16). Trained individuals used the standardised and formally published tools (Leedy & Ormrod, 2015:73-74) which also assisted in ensuring reliability and validity. Maintaining basal and ceiling levels helps ensure that the study appropriately assesses the skills of the participants and minimises the possibility of ceiling or floor implications, which can assist in improving the reliability and validity of the study's outcomes (Stone-MacDonald, Pizzo & Feldman, 2018).

Ethical considerations

Consent was obtained from various stakeholders as outlined in the Data Collection Procedures. The participants' information is kept strictly confidential – the results of each participant were assigned an alphanumeric code when stored. These regulations entail that any collected data (i.e. original dataset with perhaps identifiable information) and other related information (i.e. recordings, transcriptions) will be stored in a secure storage space (i.e. electronic data or hard-copy data). Access to the original data will be limited to this research project's team members (Appendix F).

Results

The study aimed to investigate correlations between the phonemic awareness skills of segmenting and blending and the auditory discrimination skills of Grade 4 learners who recently transferred from Setswana L1 instruction to English as LoLT. Furthermore, the study aimed to investigate correlations between auditory discrimination and reading speed and spelling skills of English L2 participants in the same group described above. It is hypothesised that there would be a significant correlation between auditory discrimination, syllable and phoneme segmentation and blending, and literacy skills. For this study, all age-equivalent scores below 9 years, 0 months (9-0) were considered inappropriate.

Average age-equivalent auditory discrimination, syllable and phoneme blending and segmenting, reading speed and spelling skills score

In Table 1, the results of the various assessments are portrayed.

Table 1. Mean, median, standard deviation (SD), minimum (Min), maximum (Max), age-equivalent scores, average scores of participants, and age-appropriate and not age-appropriate results for continuous variables.

Variable	Mean	Median	SD	Min	Max	Age-equivalent scores	Average scores of participants	% Age-appropriate	% Not age-appropriate
Auditory discrimination skills	-	-	-	-	-	94.00	22.71	4.80	95.20
Syllable blending	79.96	100.0	32.355	0	100.00	50.00	80.00	84.30	15.70
Syllable segmenting	65.20	83.00	32.068	0	100.00	50.00	65.00	78.30	21.70
Phoneme blending	62.88	67.00	30.904	0	100.00	50.00	63.00	78.30	21.70
Phoneme segmenting	48.40	50.00	30.624	0	100.00	50.00	48.00	59.00	41.00

Reading speed	-	-	-	-	-	58.00	36.61	24.10	75.90
Spelling skills	-	-	-	-	-	47.00	11.26	0	100.00

In Figure 1, the age-equivalent and average scores of participants across all assessment areas are portrayed.

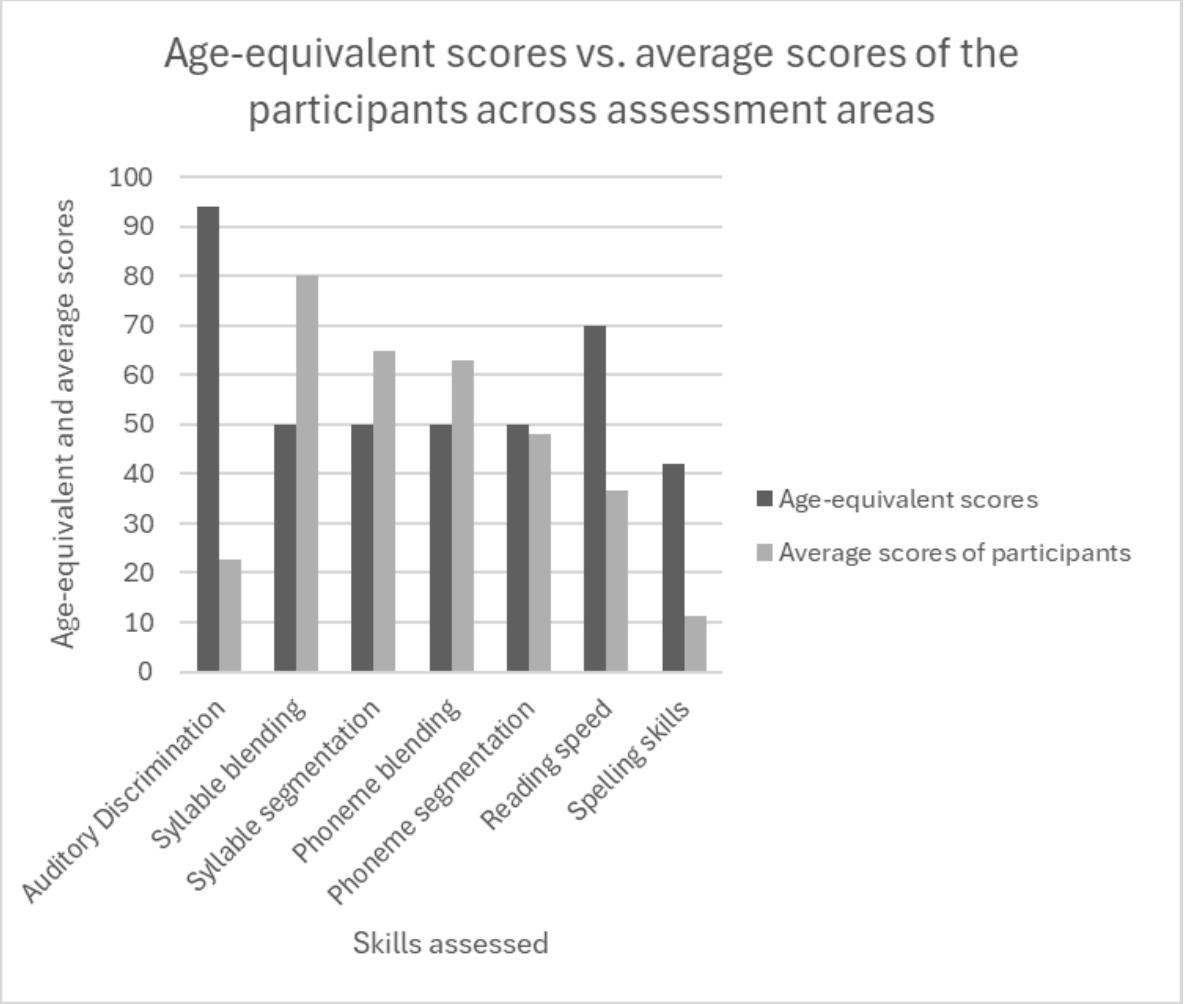

Figure 1. Participants' age-equivalent and average scores across auditory discrimination, syllable blending and segmenting, phoneme blending and segmenting, reading speed and spelling skills.

Correlations between auditory discrimination skills and the scores of syllable and phoneme segmenting and blending skills

The strength of the correlation coefficients (r_s) are interpreted as indicated in Table 2 according to Owens et al. (2021) and Téllez, García, and Corral-Verdugo (2015).

Table 2. Interpretation of the strength of the correlations

Strength of correlation	**Correlation coefficient (r_s) values**
Weak	< 0.01
Weak to moderate	$0.10 < r_s < 0.30$

Moderate	= 0.30
Moderate to strong	$0.30 < r_s < 0.50$
Strong	$r_s > = 0.50$

Table 3 elucidates the relationships between auditory discrimination skills and four phonological awareness tasks: syllable blending, syllable segmenting, phoneme blending, and phoneme segmenting.

Table 3. Correlations (r_s) and the corresponding p-values (p) for auditory discrimination skills and syllable blending, syllable segmenting, phoneme blending, and phoneme segmenting

	Syllable blending (continuous variable)	**Syllable segmenting** (continuous variable)	**Phoneme blending** (continuous variable)	**Phoneme segmenting** (continuous variable)
Auditory discrimination skills (ordinal variable)	$r_s = 0.370$**	$r_s = 0.313$**	$r_s = 0.420$**	$r_s = 0.201$
	$p = 0.001$	$p = 0.004$	$p < 0.001$	$p = 0.068$

** indicates a statistically significant correlation.

Correlations between auditory discrimination skills, reading speed, and spelling skills

The correlation between auditory discrimination skills and reading speed and spelling skills can be seen in Table 4.

Table 4. Correlations (r_s) and the corresponding p-values (p) for auditory discrimination skills, reading speed, and spelling skills

	Reading speed (ordinal variable)	**Spelling skills** (ordinal variable)
Auditory discrimination skills (ordinal variable)	$r_s = 0.448$*	$r_s = 0.500$*
	$p < 0.001$	$p < 0.001$

*indicates a statistically significant correlation.

Figure 2 shows the correlations between auditory discrimination, PA skills, PhA skills and literacy skills.

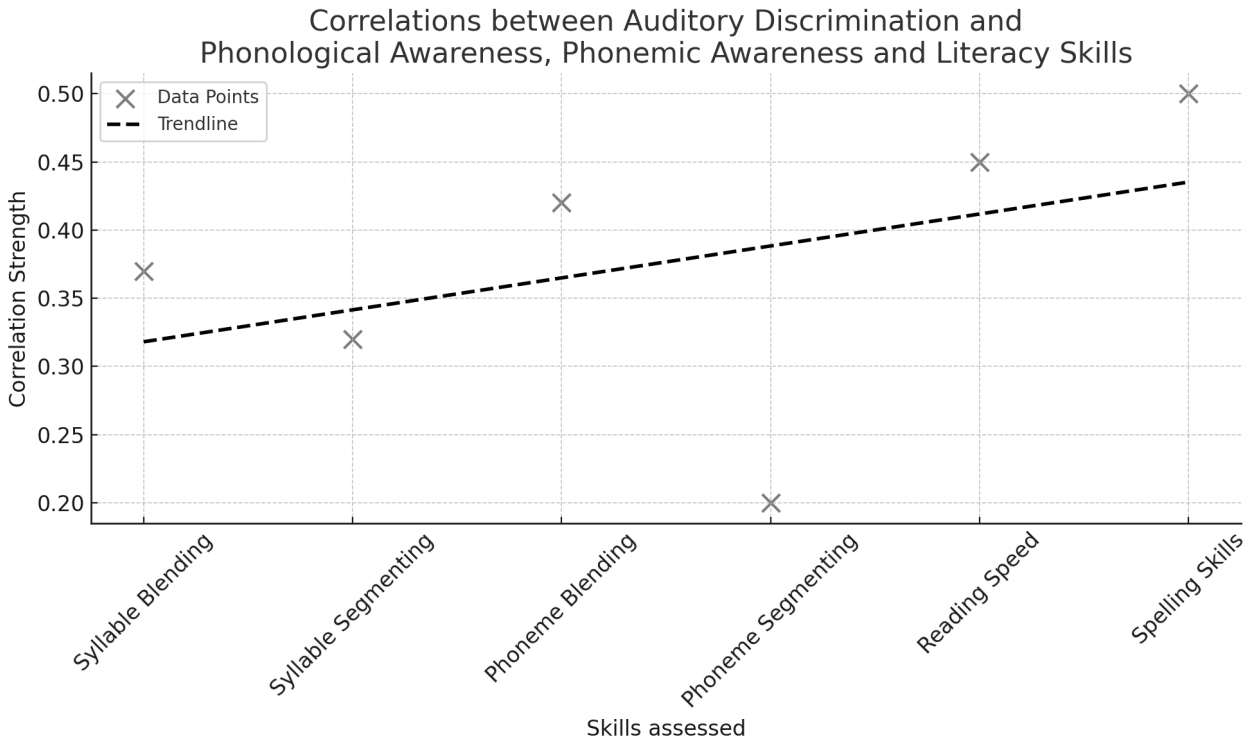

Figure 2. The correlations between Auditory Discrimination, PA, PhA, Reading Speed, and Spelling Skills.

Discussion

This study explored the relationship between auditory discrimination, PA skills (specifically syllable blending and segmenting), PhA skills (including phoneme blending and segmenting), and reading speed and spelling skills in Grade 4 EL2 learners who transitioned from Setswana L1 instruction to English as the LoLT. The results confirm the challenges learners face in the South African multilingual educational context yet highlight the positive consequences of a multilingual context, including heightened metalinguistic awareness and facilitating the transfer of PA skills from the L1 to the L2 (Walla, 2025:944; Le Roux et al., 2025:3). The findings present valuable insights into PA –, PhA –, and literacy skill development of EL2 learners.

The auditory discrimination sub-test of the *TAPS-3* was used to assess whether participants could distinguish phonological differences between similar-sounding word pairs, for example, “rot” and “rut” (Martin & Brownell, 2005). Participants obtained an average age-equivalent skill score of 22.71 for auditory discrimination, with the age-equivalent score for this skill being 94. Auditory discrimination particularly relies on a learner's ability to perceive delicate phonemic contrasts, especially vowel differences. In the *TAPS-3* subtest, successful auditory discrimination of nine out of the 32-word pairs (28.13% of the subtest) depends on differentiating vowel differences (Le Roux, 2016:268). Furthermore, 31 of the 32 word pairs contain vowels and diphthongs that are not present in Setswana including [ɪ], [e], [æ], [ɑ], [ʌ], [ɒ], [eɪ], [ə], [əʊ], [ɔ:], [ə˞], [aʊ] (Bekker:2009; Le Roux et al., 2017:2). According to Seeff-Gabriel (2003:305), EL2 learners often experience challenges in distinguishing English vowels, since many of these vowels are

absent from their L1 phoneme inventory, reducing their sensitivity to these sounds. In addition, learners are more likely to pay attention to the meaning of a word than to the individual sounds (Phillips, Clancy-Menchetti & Lonigan, 2008:3). EL2 learners often lack a well-developed L2 vocabulary (Hjetland et al., 2023:7) and thus, experience meaning loss during auditory discrimination tasks in the L2 (Le Roux, 2016:268). Only 4.8% of learners demonstrated age-appropriate auditory discrimination skills, underscoring the urgent need to support the development of auditory discrimination skills for EL2 learners.

To assess foundational PA skills, the syllable blending and segmenting sub-tests of the *PAST* (Kilpatrick, 2018) were used to evaluate the learners' ability to combine syllables to form words, for example, "rain + bow = rainbow", and to divide words into their constituent syllables, for example, "bedroom = bed + room". The participants obtained an average age-equivalent skill score of 80 for syllable blending and 65 for syllable segmenting. The participants' average scores for both skills exceeded the age-equivalent score of 50. Syllable blending and segmenting are basic PA skills, laying the foundation for later PhA skills and literacy development (Anthony & Lonigan, 2004:44; Bernthal et al., 2017:303). EL2 learners' experience with the transparent orthographies of their L1 in Grades 1 to 3 may strengthen PA skills due to a close correspondence between the letters and sounds, facilitating syllable blending, segmenting and, thus, enhanced metalinguistic awareness (Ziegler & Goswami, 2005:3,4). The development of PA in the L1 forms the foundation for transferring PA skills to the L2 (Krenca et al., 2019:21), which could explain why the participants achieved higher PA scores than expected. EL2 learners may be more sensitive to syllables than to phonemes (Wilsenach, 2019:3) since syllable awareness develops before phoneme awareness (Phillips et al., 2008:3; Vazeux et al., 2020:1). In Setswana, syllables predominantly end with vowels which are characteristic of an open syllabic structure (Mahura & Pascoe, 2016:534). These phenomena provide a possible explanation for the high average syllable blending and segmenting scores obtained by participants in this study. However, this positive effect of multilingualism may not persist into the later educational years when English's opaque orthography becomes more challenging, affecting reading skill development negatively (Probert & de Vos, 2016:3; Wilsenach, 2019:8).

The *PAST's* (Kilpatrick, 2018) subtest for phoneme blending and segmenting was used to evaluate participants' ability to synthesise isolated phonemes into a whole word for example, "/b/ /e/ /d/ = bed" and to analyse a word into its constituent sounds, for example, "ship = /sh/ /i/ /p/". Participants obtained an average age-equivalent skill score of 63 for phoneme blending and 48 for phoneme segmenting. The age-equivalent score for phoneme segmenting and blending is 50, indicating that participants performed better than expected. Despite advanced scores in simpler tasks like syllable blending, the participants' slightly weaker phoneme segmenting ability emphasises the increased complexity as PA progresses to PhA skills. PhA is a more reliable predictor of reading success than syllable awareness (Wilsenach, 2019:9). Thus, it is perturbing that the participants in this study achieved lower scores for the skill that is a better predictor of literacy outcomes. Phoneme blending is generally easier than segmenting because it requires recognition rather than manipulation of sounds (Cisero & Royer, 1995:276), supporting the participants' higher phoneme blending scores than phoneme segmenting.

The One-Minute reading test (Transvaal Education Department, 1987) was used to assess the participants' reading speed, and the Schonell spelling test (Schonell & Schonell, 1971) to evaluate spelling skills. Participants obtained an average skill score of 36.61 for reading speed, significantly below the age-equivalent score of 58. The participants' age-equivalent skill score of 11.26 for spelling skills was also significantly below the age-equivalent score of 47. The reading speed and spelling skills results confirmed the critical role of contextual factors in acquiring these skills (Hogan, Catts & Little, 2005:285). The positive effect of well-developed PA skills on literacy skill development diminishes as the learner progresses to more intricate academic tasks during the early years of schooling in languages with transparent orthographies, increasingly affecting opaque orthographies (Furnes & Samuelsson, 2010:119). This validates that PA skills are not the only predictors of successful literacy skill acquisition. Despite the participants' average-to-above-average PA and PhA skills, only 24.1% demonstrated age-appropriate reading speed, and none had age-appropriate spelling skills, which is concerning. The participants' low literacy skill scores can be attributed to a possible overlap in phonological structures between English and those of the African languages, enhancing participants' blending and segmenting skills on an isolated phoneme and syllable level. However, the lack of generalisation of phoneme and syllable blending and segmenting to more complex tasks like reading speed and spelling skills may affect literacy skill development negatively (Goswami, 2002:146). Decoding abilities depend on the orthography of the L1 since specific decoding strategies are employed early (Acha, Rodriguez & Perea, 2023:371). The transfer of these strategies from the L1 to the L2 is not reliable when the L2 orthography is less transparent than that of the L1 (Goswami, 2002:142; Probert & De Vos, 2016:2). This is the case with the opaque English orthography compared to that of Setswana, which is transparent. In addition, EL2 learners often have a limited English vocabulary and L2 exposure, resulting in limited sight word recognition (Zeng et al., 2025:3,4). Sight word recognition affects reading speed, possibly explaining the participants' low reading speed scores (Wilsenach, 2019:9), regardless of the appropriate phoneme blending skills scores obtained. The inadequate reading and spelling skills of participants may thus be associated with the transition from a transparent to an opaque orthography, highlighting its importance in acquiring literacy skills (Probert & De Vos, 2016:8).

Moderate to strong positive correlations were found between auditory discrimination and syllable blending (r_s = 0.370; p = 0.001), syllable segmenting (r_s = 0.313; p = 0.004) and phoneme blending (r_s = 0.420; $p < 0.001$), indicating that auditory discrimination is foundational to PA and PhA skill development (Couvee et al., 2022:311; Corriveau et al., 2010: 370; Eccles et al., 2021:383-384; Janssen et al., 2016:2). Auditory discrimination and phoneme segmenting had a weak to moderate positive correlation (r_s = 0.201; p = 0.068). This could be attributed to auditory discrimination relying on bottom-up processing, requiring the listener to identify the phonemes heard. In contrast, phoneme segmentation relies more on top-down processing and using background knowledge of the language to break down a word (Zoghbor, 2016:3). Transitioning from a transparent Setswana orthography to English's opaque orthography increases the demands on top-down processing involved in more complex phoneme segmenting tasks (Spaull, Pretorius & Mohohlwane, 2020:4; Yee et al., 2023:1). Auditory discrimination skills are thus less affected by the differing orthographies in comparison with phoneme segmenting skills, explaining the weak to moderate positive correlation found in this study (Nayernia, van de Vijver & Indefrey, 2019:1403).

A concerning 95,2 % of the participants in this study did not present with age-appropriate auditory discrimination skills. A moderate to strong positive correlation between auditory discrimination and reading speed (r_s = 0.448; p < 0.001) was found. As such, second language learners with poor auditory discrimination skills are less likely to accurately distinguish between the sounds, particularly vowels that do not occur in the L1 vowel inventory. In turn, this causes these learners to have difficulty in developing efficient reading skills such as fluent reading speed (Johann et al., 2020:324-325; Snowling & Hulme, 1994:25). Learners rely on contextual cues instead of phonetic knowledge to decode words, which affects reading speed (Lonigan, 2007:16).

A strong positive correlation between auditory discrimination and spelling skills (r_s = 0.500; p < 0.001) was determined, indicating that zero percent of the participants had age-appropriate spelling skills. Furthermore, accurate spelling is associated with strong awareness of the individual phonemes and the ability to sequence them correctly (Ehri, 2022:56,59; Treiman, 2017:84). Learners may also experience challenges with matching the correct phoneme to the corresponding grapheme, which can be ascribed to the difference in orthographies, affecting phoneme-grapheme correspondence negatively (Lonigan, 2007:16; Sammour-Shehadeh, Prior & Khan-Horwitz, 2025:2). The moderate to strong positive correlation between auditory discrimination and phoneme blending (r_s = 0.420; p < 0.001) suggested that deficits in sound differentiation still impact later literacy skills such as spelling skills and reading speed (Schaffler et al., 2021:556). These results confirm that auditory discrimination is a significant correlate of later literacy skill acquisition in EL2 (Couvee et al., 2022:311).

Regardless of moderate to strong positive correlations of syllable blending with reading speed (r_s= 0.309; p = 0.005) and spelling skills (r_s = 0.478; p < 0.001) as well as syllable segmenting with reading speed (r_s = 0.381; p < 0.001) and spelling skills (r_s = 0.464; p < 0.001), strong foundational PA skills do not always guarantee adequate literacy skill development when considering the multilingual context (Wealer et al., 2022:1280). Although EL2 often present with enhanced metalinguistic awareness and vigorous PA and PhA skills in their L1 (Walla, 2025:944), the positive association with the acquisition of literacy skills in an L2 is diminished when the orthographies of the two languages differ (Goswami, 2002:142; Probert & De Vos, 2016:2). Furthermore, results indicated that there was a strong positive correlation between phoneme blending and spelling skills (r_s = 0.645; p < 0.001), confirming that these PhA skills facilitate phoneme-grapheme correspondence (Eslick et al., 2020:2; Goswami & Bryant, 1990:2) and subsequent literacy skill development. Interestingly, there was a weak to moderate positive correlation between phoneme segmenting and reading speed (r_s = 0.291; p = 0.008), suggesting that while phoneme segmenting is somewhat related to reading speed, phoneme blending skills may play a more significant role in supporting both reading speed and spelling skills (Elhassan, Crewther & Bavin, 2017:6).

The results of this study advocate for the need for structured, sustained input, focused on enhancing L2 abilities, to improve the literacy outcomes of EL2 learners. Starting in Grade R, intensive intervention and explicit instruction may provide the necessary PA, PhA, and auditory discrimination skills to reduce the cumulative effects of delayed literacy acquisition in EL2 learners. This is especially important in South Africa, where many learners only transition to English as the LoLT at the beginning of Grade 4 without fully mastering PA skills in their L1.

This study provided valuable local discernments, highlighting that auditory discrimination is closely associated with PhA and early literacy outcomes. Previous studies investigated PA and PhA skills as the main predictors of literacy skill outcomes in EL2 (Eslick et al., 2020:2; Le Roux et al., 2017:16; Le Roux et al., 2025:7; Manten et al., 2020:143). Additionally, the current study suggests that auditory discrimination provides a better indication of literacy skill development in a multilingual context involving transitions between languages with differing phoneme inventories and orthographies. PhA and literacy skills reflect both environmental and language barriers EL2 learners face in multilingual contexts, where access to high-quality early literacy experiences is often limited. Explicit instruction in auditory discrimination and PA should begin early and be systematically integrated into L1 and L2 literacy instruction for EL2 learners to thrive in an L2 academic environment.

Conclusion

This study examined correlations between auditory discrimination, PA, PhA, and specific literacy outcomes in 83 Grade 4 Setswana-speaking learners transitioning to English as the LoLT. A quantitative, retrospective, correlational design using standardised assessments revealed significant positive correlations between auditory discrimination and reading speed ($r_s = 0.448$, $p < 0.001$), as well as between auditory discrimination and spelling skills ($r_s = 0.500$, $p < 0.001$). Moderate correlations emerged with blending and segmenting tasks. The null hypothesis (Ho) stated that no statistically significant correlation would be found between auditory discrimination and the PhA skills of segmenting and blending of Grade 4 learners who have recently transitioned from L1 instruction in Setswana to English as their LoLT, having only been exposed to English as an additional language for the first three years of schooling. The alternative hypothesis (Ha) proposed that a statistically significant correlation will exist between auditory discrimination and the PhA skills of segmenting and blending in this group. The alternative hypothesis (Ha) is therefore partially accepted.

Despite some relatively strong PA and PhA skills, learners demonstrated poor literacy outcomes, highlighting the impact of transitioning between transparent and opaque orthographies on literacy acquisition in multilingual contexts. By addressing these foundational skills, educators can equip learners with the skills they need to develop successful literacy skills, narrowing the achievement gap in under-resourced contexts.

Limitations and future recommendations

The study's limitations were that the English standardised test norms (although validated for multilingual international populations) did not account for the present participants' specific educational background or experience, especially in the L1. Furthermore, the *PAST* test used to evaluate syllable and phoneme blending and segmenting skills had limited test items, which may have influenced the results. Future research should consider different assessment tools to determine correlations between auditory discrimination, PA–, PhA– and literacy skills. Structured and explicit instructional programs should be tailored and adapted to address auditory discrimination and PhA skills, which are still lacking, where more complex academic written language negatively impacts complex educational contexts at different stages.

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Appendices:

Appendix A:

Faculty of Humanities
Fakulteit Geesteswetenskappe
Lefapha la Bomotho

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Humanities 100
Since 1919

17 September 2020

Dear Dr M le Roux

Project Title:	Enhancing literacy skills: an e-approach in a rural school in Gauteng Province, South Africa.
Researcher:	Dr M le Roux
Supervisor(s):	
Department:	Speech Language Path and Aud
Reference number:	04433585 (HUM039/0720)
Degree:	Staff Research / Non Degree

I have pleasure in informing you that the above application was **approved** by the Research Ethics Committee on 17 September 2020. Data collection may therefore commence.

Please note that this approval is based on the assumption that the research will be carried out along the lines laid out in the proposal. Should the actual research depart significantly from the proposed research, it will be necessary to apply for a new research approval and ethical clearance.

We wish you success with the project.

Sincerely,

Prof Innocent Pikirayi
Deputy Dean: Postgraduate Studies and Research Ethics
Faculty of Humanities
UNIVERSITY OF PRETORIA
e-mail: PGHumanities@up.ac.za

Fakulteit Geesteswetenskappe
Lefapha la Bomotho

Appendix B:

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Faculty of Humanities
Fakulteit Geesteswetenskappe
Lefapha la Bomotho

Humanities 100 Since 1910

Department of Speech- Language Pathology and Audiology

20 February 2025

Dear Researchers,

Project:	**Correlations of auditory discrimination, phonemic awareness and literacy: evidence from a Grade 4 classroom in rural Gauteng**
Researchers:	**Inge Dörfling (u22644807); Marizaan Müller (u21430391); Jana van der Merwe (u22595849); Mary-Ann Viviers (u22590791)**
Supervisors:	**Prof M le Roux, Prof S Geertsema**
Department:	**Department of Speech-Language Pathology and Audiology**
Reference Number:	**SLPA 2025/05**

Thank you for the application submitted to the Research Committee of the Department of Speech-Pathology and Audiology, Faculty of Humanities. We want to inform you that the above application was approved.

The approval is subject to the candidates abiding by the principles and parameters set out in the application

We wish you success with the project.

Sincerely

Prof Lidia Pottas
Chair: Departmental Research Committee

Prof J van der Linde
HEAD: DEPARTMENT OF SPEECH-LANGUAGE PATHOLOGY AND AUDIOLOGY
UNIVERSITY OF PRETORIA

Room 7.22, Level 7, Humanities Building
University of Pretoria, Private Bag X20
Hatfield 0028, South Africa
Email makone.maja@up.ac.za | www.up.ac.za

Appendix C:

GAUTENG PROVINCE
Department: Education
REPUBLIC OF SOUTH AFRICA

8/4/4/1/2

GDE RESEARCH APPROVAL LETTER

Date:	23 June 2020
Validity of Research Approval:	04 February 2020 – 30 September 2020 2019/485
Name of Researcher:	Le Roux ,M
Address of Researcher:	1346 Walter Avenue
	Waverley
	Pretoria
Telephone Number:	0835661065
Email address:	Mia.leroux@up.ac.za
Research Topic:	Enhancing literacy skills: an e-approach in a rural school in Gauteng
Type of qualification	PHD
Number and type of schools:	1 Primary School
Districts/HO	Tshwane North

Re: Approval in Respect of Request to Conduct Research

This letter serves to indicate that approval is hereby granted to the above-mentioned researcher to proceed with research in respect of the study indicated above. The onus rests with the researcher to negotiate appropriate and relevant time schedules with the school/s and/or offices involved to conduct the research. A separate copy of this letter must be presented to both the School (both Principal and SGB) and the District/Head Office Senior Manager confirming that permission has been granted for the research to be conducted.

23/06/2020

The following conditions apply to GDE research. The researcher may proceed with the above study subject to the conditions listed below being met. Approval may be withdrawn should any of the conditions listed below be flouted:

1. *Letter that would indicate that the said researcher/s has/have been granted permission from the Gauteng Department of Education to conduct the research study.*

Office of the Director: Education Research and Knowledge Management
7th Floor, 17 Simmonds Street, Johannesburg, 2001
Tel: (011) 355 0488
Email: Faith.Tshabalala@gauteng.gov.za
Website: www.education.gpg.gov.za

2. *The District/Head Office Senior Managers must be approached separately, and in writing, for permission to involve District/Head Office Officials in the project.*
3. ***Because of COVID 19 pandemic researchers can ONLY collect data online, telephonically or may make arrangements for Zoom with the school Principal. Requests for such arrangements should be submitted to the GDE Education Research and Knowledge Management directorate. The approval letter will then indicate the type of arrangements that have been made with the school.***
4. ***The Researchers are advised to make arrangements with the schools via Fax, email or telephonically with the Principal.***
5. *A copy of this letter must be forwarded to the school principal and the chairperson of the School Governing Body (SGB) that would indicate that the researcher/s have been granted permission from the Gauteng Department of Education to conduct the research study.*
6. *A letter / document that outline the purpose of the research and the anticipated outcomes of such research must be made available to the principals, SGBs and District/Head Office Senior Managers of the schools and districts/offices concerned, respectively.*
7. *The Researcher will make every effort obtain the goodwill and co-operation of all the GDE officials, principals, and chairpersons of the SGBs, teachers and learners involved. Persons who offer their co-operation will not receive additional remuneration from the Department while those that opt not to participate will not be penalised in any way.*
8. *Research may only be conducted after school hours so that the normal school programme is not interrupted. The Principal (if at a school) and/or Director (if at a district/head office) must be consulted about an appropriate time when the researcher/s may carry out their research at the sites that they manage.*
9. *Research may only commence from the second week of February and must be concluded before the beginning of the last quarter of the academic year. If incomplete, an amended Research Approval letter may be requested to conduct research in the following year.*
10. *Items 5 and 7 will not apply to any research effort being undertaken on behalf of the GDE. Such research will have been commissioned and be paid for by the Gauteng Department of Education.*
11. *It is the researcher's responsibility to obtain written parental consent of all learners that are expected to participate in the study.*
12. *The researcher is responsible for supplying and utilising his/her own research resources, such as stationery, photocopies, transport, faxes and telephones and should not depend on the goodwill of the institutions and/or the offices visited for supplying such resources.*
13. *The names of the GDE officials, schools, principals, parents, teachers and learners that participate in the study may not appear in the research report without the written consent of each of these individuals and/or organisations.*
14. *On completion of the study the researcher/s must supply the Director: Knowledge Management & Research with one Hard Cover bound and an electronic copy of the research.*
15. *The researcher may be expected to provide short presentations on the purpose, findings and recommendations of his/her research to both GDE officials and the schools concerned.*
16. *Should the researcher have been involved with research at a school and/or a district/head office level, the Director concerned must also be supplied with a brief summary of the purpose, findings and recommendations of the research study.*

The Gauteng Department of Education wishes you well in this important undertaking and looks forward to examining the findings of your research study.

Kind regards

.....

Mr Gumani Mukatuni
Acting CES: Education Research and Knowledge Management

DATE: 23/06/2020

Making education a societal priority

Office of the Director: Education Research and Knowledge Management
7th Floor, 17 Simmonds Street, Johannesburg, 2001
Tel: (011) 355 0488
Email: Faith.Tshabalala@gauteng.gov.za
Website: www.education.gpg.gov.za

Appendix D:

The Principal

Mmabana Primary School

3 March 2022

Dear Advocate Molapo

Consent request for the following research project to be launched at the Mmabana Primary school: *Enhancing literacy skills: an e-approach in a rural school in Gauteng, South Africa.*

I am Dr Mia le Roux, a senior lecturer in the Department of Speech-Language Pathology and Audiology, University of Pretoria. My colleague, Dr Salomé Geertsema from the same department, and I would like to conduct a research study aimed at determining and describing the outcomes of an electronic literacy enhancement program introduced to Grade 4 English second language learners. To achieve this, we would like to investigate and compare the early literacy and literacy skills of intermediate phase learners, in Grade 4, before and after the introduction of an electronic literacy enhancement program. The electronic literacy enhancement program is a project by the World Literacy Foundation (WLF), employing their initiative Sun Books for the implementation of the program. A representative of the WLF and Sun Books has been in contact with the Gauteng Department of Education in this regard.

Dr Geertsema and I will not be involved in the literacy enhancement program; we will only assess the participants' early and later literacy skills before and after the implementation of the electronic literacy enhancement program. As part of the research project, we request permission from you to initiate this research project Mmabana Primary School. We have also applied for and received consent from the Gauteng Department of Education and approached the chairperson of the school governing body. We would like to ask your consent and assistance to distribute the letters of consent to the parents/caregivers of the learners, requesting their permission to involve their children in this research study. The children will also have to provide assent to participate in this project.

The research project requires girls and boys who are currently in Grade 4 to become involved as participants. The participants in the experimental group who take part in the electronic literacy enhancement program will do the programmed activities on tablets in class as scheduled by the teachers. The participants in the control group will not take part in the electronic literacy enhancement program, but will still be assessed by the researchers before the experimental group starts with the program as well as at the end of the program. We plan to involve two Grade 4 classes at the school in the following way: one Grade 4 class would act as the experimental group and another Grade 4 class as the control group. Participants have the right to withdraw from the research at any time, without having to explain why. Participants will have the opportunity to ask questions about the proposed study before signing consent and have the right to access their data.

The researchers will have to assess the learners in Grade 4 who will take part in the project, meaning that we kindly ask for consent to remove the participants from their classrooms and assess them in a quiet venue in the school building. This will happen only twice: once before the commencement of the literacy enrichment program, and once at the completion of this program. The duration of the

assessment will be approximately 90 minutes per learner. Final year speech-language pathology students qualified to administer the specific tests will conduct the assessments.

If prospective participants present with reported Specific Learning Disorder (SLD) (Dyslexia), hearing impairments, reported uncontrolled ADHD and reported untreated visual impairments, they will be excluded from the study. Hearing screening will form part of the initial battery of assessments. Learners who fail these hearing screening procedures will also be excluded. (They will be referred for a complete audiological evaluation). Information about the above-reported conditions will be obtained from the teachers. Each Grade 4 teacher will receive a checklist to assist them in identifying possible candidates for the study. This checklist will identify the exclusion criteria (that the child may not present with) which are stated under the next heading.

The early literacy and later literacy skills of participants in both groups will be assessed before and after the roll-out of the electronic literacy enhancement program. These assessments will entail the use of the following standardised tools:

- Test of Auditory Comprehension of Language 3rd ed. (TACL-3)
- Test of Auditory Processing Skills 3rd ed. (TAPS-3)
- One Minute Reading Test
- Stark-Griffin Dyslexia Determination Test (Encoding sub-section)
- Phonological Awareness Test 2nd ed. (Normative update) (PAT-2)
- Gray Oral Reading Tests 4th ed. (GORT-4)

Although the aim of the study is not to diagnose any speech-, language-, or hearing difficulties and/or disorders, participants who present with possible developmental deficits will be referred for further assessments and treatments, in order to adhere to ethical procedures. We do not foresee any inconvenience to the participants.

The information acquired during the research study is highly confidential. The answer sheets will be completed with only an alpha-numerical code, not the names of the participants. The details of the participating school and participants will not be disclosed on any documents. Data will be stored at the Department of Speech-Language Pathology and Audiology, University of Pretoria, for 15 years in electronic and hard copy. The data collected will be used in the writing of scientific articles and in the form of conference papers.

For any further questions, please contact:

Researchers: Dr Mia le Roux mia.leroux@up.ac.za

Dr Salomé Geertsema salome.geertsema@up.ac.za

Thanking you in advance,

Yours sincerely,

Dr Mia le Roux Dr Salomé Geertsema

\

Researcher

Researcher

Prof J van der Linde

Head: Department of Speech-Language Pathology and Audiology, University of Pretoria

Title of study: *Enhancing literacy skills: an e-approach in a rural school in Gauteng*

ETHICAL APPROVAL NUMBER: HUM039/0720

WRITTEN CONSENT TO PARTICIPATE IN THIS STUDY

I, _____ **Principal of Mmabana Primary School**, confirm that the person asking my consent on behalf of Mmabana Primary School, for the school to form part of this research has told me about the nature, procedure, potential benefits, and anticipated inconvenience of participation. I understand that participation is voluntary and that the school / designated groups of learners are free to withdraw at any time, without giving any reason, and without any consequences or penalties.

I understand that information collected during the study will not be linked to the identities of the learners and I give permission to the researchers involved with this study to access the information.

I understand that this study has been reviewed by, and received ethical clearance from, the Research Ethics Committee, Faculty of Humanities of the University of Pretoria.

I understand who will have access to the personal information of the learners as participants and how the information will be stored with a clear understanding that the learners of this school will not be linked to the information in any way.

I understand how this study will be written up and published.

I understand how to raise a concern or make a complaint.

_____	_____	_____
Principal:	Date	Signature

Mmabana Primary School

_____

Appendix E:

Faculty of Humanities
Fakulteit Geesteswetenskappe
Lefapha la Bomotho

3 March 2022

Dear Parent/Caregiver

Consent request for including your child/charge in the following research project to be launched at the Mmabana Primary school: *Enhancing literacy skills: an e-approach in a rural school in Gauteng, South Africa.*

I am Dr Mia le Roux, a senior lecturer in the Department of Speech-Language Pathology and Audiology, University of Pretoria. My colleague, Dr Salomé Geertsema from the same department, and I would like to conduct a research study aimed at determining and describing the outcomes of an electronic literacy enhancement program introduced to Grade 4 English second language learners. To achieve this, we would like to investigate and compare the early literacy and literacy skills of intermediate phase learners, in Grade 4, before and after the introduction of an electronic literacy enhancement program. The electronic literacy enhancement program is a project by the World Literacy Foundation (WLF), employing their initiative Sun Books for the implementation of the program. A representative of the WLF and Sun Books has been in contact with the Gauteng Department of Education (GDE) in this regard. I have also requested and received consent from the GDE, the school governing body as well as the principal for the research project to be launched.

Dr Geertsema and I will not be involved in the literacy enhancement program; we will only assess the participants' early and later literacy skills before and after the implementation of the electronic literacy enhancement program. As part of the research project, we request permission from you to include your child/charge as a participant in this research project. If you consent to your child taking part in this research project, the child will also have to provide assent to participate in this project.

The research project requires girls and boys who are currently in Grade 4 to become involved as participants. The participants in the experimental group who take part in the electronic literacy enhancement program will do the programmed activities on tablets in class as scheduled by the teachers. The participants in the control group will not take part in the electronic literacy enhancement program, but will still be assessed by the researchers before the experimental group starts with the program as well as at the end of the program. We plan to involve two Grade 4 classes at the school in the following way: one Grade 4 class would act as the experimental group and another Grade 4 class as the control group. Participants have the right to withdraw from the research at any time, without having to explain why. Participants will have the opportunity to ask questions about the proposed study before signing consent and have the right to access their data. If possible, the control group will also have the opportunity to do the program at the completion of the research project as Sun Books indicated that the school might be able to keep the tablets.

The researchers will have to assess the learners in Grade 4 who will take part in the project. If you give consent that your child/charge may take part in the research study, we kindly ask for consent to remove him/her from the classroom and assess him/her in a quiet venue in the school building. This will happen only twice: once before the commencement of the literacy enrichment program, and once at the completion of this program. The duration of the assessment will be approximately 90 minutes per learner. Final year speech-language pathology students qualified to administer the specific tests will conduct the assessments.

If you give consent that your child/charge may take part in the research project, and he/she presents with reported Specific Learning Disorder (SLD) (Dyslexia), hearing impairments, reported uncontrolled ADHD, and reported untreated visual impairments, he/she will be excluded from the study. Hearing screening will form part of the initial battery of assessments. If he/she fails these hearing screening procedures he/she will also be excluded. He/she will be referred for a complete audiological evaluation. Information about the above-reported conditions will be obtained from the teachers. Each Grade 4 teacher will receive a checklist to assist them in identifying possible candidates for the study. This checklist will identify the exclusion criteria (that the child may not present with) which are stated under the next heading.

The early literacy and later literacy skills of participants in both groups will be assessed before and after the roll-out of the electronic literacy enhancement program. These assessments will entail the use of the following standardised tools:

- Test of Auditory Comprehension of Language 3rd ed. (TACL-3)
- Test of Auditory Processing Skills 3rd ed. (TAPS-3)
- One Minute Reading Test
- Stark-Griffin Dyslexia Determination Test (Encoding sub-section)
- Phonological Awareness Test 2nd ed. (Normative update) (PAT-2)
- Gray Oral Reading Tests 4th ed. (GORT-4)

Although the aim of the study is not to diagnose any speech-, language-, or hearing difficulties and/or disorders, if your child/charge presents with possible developmental deficits he/she will be referred for further assessments and treatments, in order to adhere to ethical procedures. We do not foresee any inconvenience to the participants.

The information acquired during the research study is highly confidential. The answer sheets will be completed with only an alpha-numerical code, not the names of the participants. The details of the participating school and participants will not be disclosed on any documents. Data will be stored at the Department of Speech-Language Pathology and Audiology, University of Pretoria, for 15 years in electronic and hard copy. The data collected will be used in the writing of scientific articles and in the form of conference papers.

For any further questions, please contact:

Researchers: Dr Mia le Roux mia.leroux@up.ac.za

Dr Salomé Geertsema salome.geertsema@up.ac.za

Thanking you in advance,

Yours sincerely,

Dr Mia le Roux

Researcher

Dr Salomé Geertsema

Researcher

Prof I van der Linde

Head: Department of Speech-Language Pathology and Audiology, University of Pretoria

Please send back to Ms Joey Mcagi

Title of study: *Enhancing literacy skills: an e-approach in a rural school in Gauteng, South Africa*

ETHICAL APPROVAL NUMBER: HUM039/0720

WRITTEN CONSENT TO PARTICIPATE IN THIS STUDY

I, _____ Parent/Caregiver of _____(name of my child/charge) in Gr 4 in Mmabana Primary School, confirm that the person asking my consent that my child/charge may form part of this research has told me about the nature, procedure, potential benefits, and anticipated inconvenience of participation in this document received. By completing and signing this form, I hereby give consent that my child mentioned above may take part in the project. If I do not complete and sign this form, I hereby indicate that I do not give consent that my child/charge may participate in the research project.

_____	_____	_____
Parent/Caregiver:	**Date**	**Signature**

Appendix F:

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Faculty of Humanities
Fakulteit Geesteswetenskappe
Lefapha la Bomotho

Humanities 100
Since 1919

3 March 2022

Child Assent Form:

Dear .....

Hello!

I am Dr Mia and this is my friend and colleague Dr Salomé. Some of our students are going to do fun ativities with you. They will ask you to listen to words and sentences, repeat what they say, read fun stories to them, answer questions about the stories that you have read, write some spelling words and also write some sentences.

If you don't enjoy it, you can show me a sad face then we will stop doing the activity.

Options:	Decision:
1. Yes, I want to play	
2. No, I do not want to play	

Dr Mia le Roux

Department of Speech-Language Pathology and Audiology,

Room 3-1.1, Communication Pathology Building

University of Pretoria, Private Bag X20

Hatfield 0028, South Africa

Faculty of Humanities
Fakulteit Geesteswetenskappe
Lefapha la Bomotho

Dr Mia le Roux

Researcher

Dr Salomé Geertsema

Researcher

Prof I van der Linde

Head: Department of Speech-Language Pathology and Audiology, University of Pretoria

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Appendix G:

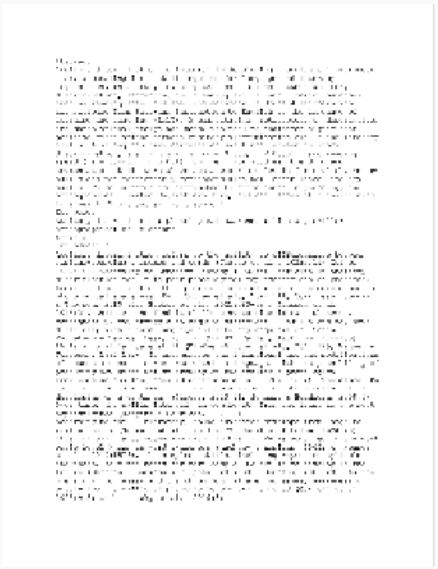
turnitin

Digital Receipt

This receipt acknowledges that Turnitin received your paper. Below you will find the receipt information regarding your submission.

The first page of your submissions is displayed below.

Submission author:	M (Marizaan) Müller
Assignment title:	Turnitin report
Submission title:	Correlations of auditory discrimination, phonemic awareness ...
File name:	copypaste.txt
File size:	42.44K
Page count:	15
Word count:	6,250
Character count:	36,906
Submission date:	09-Oct-2025 10:57AM (UTC+0200)
Submission ID:	2775770711



Correlations of auditory discrimination, phonemic awareness and literacy: evidence from a Grade 4 classroom in rural Gauteng

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5	Aileen Manten, Mia le Roux, Salomé Geertsema, Marien Graham. "An investigation into the early literacy skills of English second language learners in South Africa", Australasian Journal of Early Childhood, 2020 Publication	1%
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