Classroom pedagogies for reading in government schools in poor areas of Nigeria: Insights for policy and practice

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Abstract

Within the African context, language of instruction policies vary widely. This paper investigates whether translanguaging pedagogies offer a practical and context responsive approach to multilingual education within a specific geographical context in northern Nigeria. In this regard the study reported in this paper compares a translanguaging pedagogy, where students are encouraged to use their entire linguistic repertoire, with a monoglossic approach where languages are regarded as separate, distinct and bounded systems.

The paper sets out to investigate any cross linguistic transfer between and within languages drawing on data from 4,762 primary school pupils across 828 government schools in 13 states. The focus is on classroom pedagogical differences particularly the presence or absence of translanguaging. Descriptive statistics, bivariate correlations, path models and multilevel modelling are used to analyse relationships within the nested data structure.

Results show significant within and cross language associations. Multilevel analyses indicate that literacy outcomes are shaped by both individual and contextual factors, including language of instruction. Variance partitioning reveals differences between contexts, with translanguaging classrooms showing more variance at the pupil level and non-translanguaging classrooms greater clustering at school and state levels.

The findings could imply that translanguaging is creating a more consistent learning environment for the students across contexts. These results suggest further policy attention; that translanguaging practices may help reduce between school and regional differences, leading to a more equitable distribution of educational outcomes in different geographical contexts.

Key words: Nigeria, classroom pedagogy, translanguaging, monoglossic, bilingual instruction, cross linguistic transfer, reading decoding, phoneme letter sounds

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1. Introduction

Ineffective teacher training programmes, underfunded school infrastructure and overpopulated classrooms are cited as contributing to Nigeria's learning crisis (Adeniran, et al., 2020; Adamu et al., 2022; Ogunode et al., 2023). In Nigeria, around 73% of children aged between 7-11 years lack foundational reading skills, highlighting a significant challenge (Carlisle and Katz, 2006; Humble et al., 2024). Children in rural Nigeria account for 63% of this total with the poorest being most affected (UNICEF, 2025).

A central aim of this study is to examine how different models of literacy instruction shape cross linguistic relationships between Hausa (L1) and English (L2) reading development. In multilingual education contexts, a key distinction lies between translanguaging pedagogy, where learners are taught literacy in both languages simultaneously and a monoglossic instruction approach where languages are regarded as separate, distinct and bounded systems.

Translanguaging approaches conceptualise bilingual learners' linguistic repertoires as integrated and dynamic, enabling learners to draw on resources across languages in real time (García and Wei, 2013; Otheguy et al., 2015; Wei, 2017; García et al., 2022). In contrast, monoglossic pedagogies typically treat languages as separate systems. Teachers therefore prioritise the use of one language at a time within the classroom. Monoglossic pedagogies are based on the belief that successful learning occurs when languages remain clearly separated (Cots et al., 2022; Wei, 2017; Wei and García, 2022).

This distinction is theoretically significant, as it relates to the timing and mechanisms of cross linguistic transfer, with translanguaging potentially facilitating more immediate interaction between languages and monoglossic relying on delayed transfer processes (Cummins, 1981; Cummins, 2017; Koda, 2007).

The present study groups schools according to these instructional approaches. It investigates whether the structure and strength of relationships between phoneme sounds and word decoding differ, depending on whether literacy development pedagogies are translanguaging or monoglossic (Berens et al., 2013; Van, 2025). This distinction may have important implications for teacher training, continuing professional development and education policy.

1.1 Classroom pedagogy – translanguaging and monoglossic

In bilingual educational settings, teachers use strategies that encourage students to draw connections between languages. Research demonstrates that children studying in bilingual programs display improved academic performance owing to cognitive flexibility and metalinguistic awareness (Bialystok et al., 2012; Collier and Thomas, 2002; Cummins, 2021; Thomas and Collier, 2012). These findings indicate that maintaining the first language alongside the second can enhance cognitive development and academic achievement. Such cognitive advantages may facilitate cross language transfer by enabling learners to recognize similarities between linguistic systems and apply previously acquired knowledge to new language contexts (Cummins, 2021; Dixon et al., 2025; Humble, et al., 2024).

One pedagogical strategy is translanguaging which refers to the dynamic use of multiple languages within a single learning environment. According to García, translanguaging allows

learners to use their full linguistic repertoire to make meaning and engage with academic content (García, 2009; García and Wei, 2013). In classrooms where students use both Hausa (L1) and English (L2), they are able to compare vocabulary, grammatical structures and discourse patterns across languages, strengthening metalinguistic awareness and facilitating cross language transfer. Otheguy et al. (2015, 2019) define translanguaging as the use of an entire linguistic repertoire of a speaker. That is, bilingual and multilingual speakers possess a single unitary linguistic system. Translanguaging encourages teachers and learners to use all their languages for communication, learning and meaning making. Depending on the learning context, children are able to draw on their linguistic repertoire and hence benefit from their language fluidity (Otheguy et al., 2015; 2019). Translanguaging challenges the rigid separation of languages, believing that boundaries between languages are socially imposed and a sociopolitical construct (García, Johnson, and Seltzer, 2022; Umar and Ago, 2025; Omidire and Muhammed, 2026; Wei, 2018). Research on multilingual classrooms shows that translanguaging practices can improve learner engagement and comprehension (Canagarajah, 2018; Omidire, 2026; Ngubane and Ngwenya, 2025).

1.2 Cross linguistic transfer

Cross language transfer refers to the influence that linguistic knowledge acquired in one language has on the development of another. Research in bilingual education has demonstrated that literacy and cognitive skills developed in a first language (L1) can support learning in a second (L2) (Wealer et al., 2025). According to Cummins, language learning involves shared cognitive processes that operate across languages rather than being isolated within separate language systems (Cummins, 1981, 1988, 2017, 2021). Cummins' *Linguistic Interdependence Hypothesis* suggests that learners develop a common underlying proficiency that allows skills including reading comprehension, vocabulary knowledge and metalinguistic awareness to transfer between languages.

Studies on bilingual literacy development further support this theory. Research by Koda (2012, 2005) demonstrates that second language reading development is strongly influenced by learners' literacy skills in their first language. Similarly, phonological processing research indicates that phonological awareness developed in the first language can predict second language reading success (Sparks and Ganschow, 1993). These findings suggest that learners who develop strong literacy skills in L1 may be able to apply similar strategies when learning L2.

1.3 African research in literacy

Recent empirical research in Nigeria has continued to confirm the role of cross language transfer in bilingual learning contexts. Studies examining multilingual educational environments have found that literacy skills acquired in one language can facilitate reading comprehension and vocabulary acquisition in another language (Dixon et al., 2025, Humble et al., 2024; Kim and Piper, 2019; Wawire and Kim, 2018; Adebayo, 2016). These findings reinforce the importance of supporting learners' first language as a foundation for second language learning.

Multilingualism is a defining characteristic of many African societies. Educational systems across the continent often face challenges related to language policy and language of instruction. With over 500 indigenous languages, Nigeria is linguistically a diverse nation. In

government schools the prominent heritage languages used for instruction up to Grade 4 are Hausa (north), Igbo (southeast) and Yoruba (southwest). In northern Nigeria, Hausa (L1) serves as the major lingua franca and is widely used in everyday communication as well as at school. English (L2), recognised as a co-official language, is taught as a subject from pre-school through to Grade 4 where the medium of instruction transfers from heritage language (Hausa (L1)) to an English (L2) immersion curriculum. Heritage language (Haus (L1)) becoming a subject, rather than the language used in class. This can have detrimental effects on learning as reliance on English (L2) only education may limit learners' ability to fully understand classroom content and restrict opportunities for cross language transfer (Bamgbose, 2004; Brock-Utne, 2000).

Studies increasingly emphasize the importance of heritage based multilingual education for improving learning outcomes (Ngubane and Ngwenya, 2025; Janban, 2025; Igarashi et al., 2024). Sustained instruction in learners heritage languages can significantly improve literacy development and academic achievement (Ononiwu et al., 2021; Heugh, 2012). Similarly, language policy in African education systems suggest that learners who receive early education in their heritage language are better able to acquire literacy skills and transition to second language instruction later in their schooling (Trudell et al., 2023).

The present study makes an important and innovative contribution to understand how different pedagogical practices impact learners' development of language. The results are internationally significant and will become a primary point of reference for policy makers. There are implications for initial teacher training and continuing professional development focusing on structured and classroom pedagogies to enhance learning for all. The study offers methodological precision with data collected from thousands of pupils across hundreds of schools, in classrooms that are offering different pedagogical practices – translanguaging and monoglossic.

2. Method

2.1 Participants

This study consists of 4,762 primary school pupils from grades 2 and 3, of which 51.5% are female, with a mean age of 8.8 years (SD 1.3 years), drawn from 828 schools across 13 states of northern Nigeria. The data were collected between June and August 2025. The schools taking part in this study categorise themselves into two pedagogical approaches within their classrooms, that is either a translanguaging approach or a monoglossic approach.

A total of 1,491 pupils are in classrooms that adopt a translanguaging pedagogy, where students are encouraged to use their entire linguistic repertoire during their reading, decoding and letter sound recognition (phoneme) lessons for both Hausa (L1) and English (L2) (Umar and Ago, 2025; Omidire and Muhammed, 2026; Li Wei, 2017). Second a total of 3,271 pupils are drawn from classrooms with a monoglossic approach where both Hausa (L1) and English (L2) are regarded as separate, distinct and bounded systems during their reading, decoding and letter sound recognition (phoneme) lessons (Berens et al., 2013; Van, 2025). This grouping reflects a theoretical contrast between translanguaging and monoglossic approaches to literacy development (García, 2009; García and Wei, 2013; Otheguy et al., 2015). This allowed for comparisons between the different pedological approaches to language teaching in relation to cross language transfer and language development.

2.2 Instruments

Pupils were tested in both their heritage language, Hausa (L1) and English (L2). Two measures in each language were administered – letter sound (phoneme) knowledge and word reading assessment (reading decoding). Therefore, four different tests were administered in total. Hausa and English are not phonologically identical; however, they have some similar phonemes and some vowel phonemes in common (Dixon et al., 2025).

The Hausa letter sound (phoneme) knowledge assessment evaluated pupils' ability to produce the correct phonemes for 35 graphemes, including 10 digraphs. These graphemes represent common sound symbol correspondences in the Hausa writing system. The Hausa alphabet omits the letters 'x', 'v', 'p', and 'q' but having letter combinations with two or more forms for 'b', 'd', 'f', 'g', 'k', and 'y'. The Hausa word reading assessment required pupils to read 40 words, consisting of 20 real words and 20 invented decodable words constructed according to the phonological rules of Hausa. These assessments were developed by linguistics researchers from the Federal University of Gusau, Zamfara State, Nigeria to ensure linguistic and orthographic accuracy and have been used in previous studies (Counihan et al., 2021; Humble et al., 2024; Dixon et al., 2025). In order to consider the validity and reliability of the Hausa tests a pilot was undertaken in Zamfara State with 50 pupils. The Hausa sound test achieved a Cronbach's alpha coefficient of 0.90 and the Hausa word reading test an internal reliability of $\alpha = 0.78$.

The English (L2) literacy measures were administered in English (L2). The English letter sound (phoneme) knowledge assessment measured pupils' ability to correctly pronounce the phonemes associated with 41 graphemes including 17 digraphs. The selected graphemes reflected commonly accepted correspondences between English phonemes and their most frequent written representations. The English word reading assessment used the 2019 version of the UK Government's Phonics Screening Check. This assessment measures pupils decoding ability by asking them to read 40 words, consisting of 20 real words (e.g., *plug*) and 20 pseudo words (e.g., *yad*). Pseudo words are phonically decodable but do not carry lexical meaning, allowing the assessment to isolate decoding ability rather than vocabulary knowledge. Duff et al. (2014), repot that the Phonics Screening Check demonstrates strong correlations with other literacy skills being a valid and sensitive instrument. The assessment exhibits convergent and discriminant validity. Furthermore, the Standards and Testing Agency (2012) report a high level of internal reliability for the Phonics Screening Check with a Cronbach's alpha coefficient of $\alpha = 0.96$.

2.3 Procedure

All assessments were administered using a custom designed smartphone assessment application. The application presented each stimulus item individually, displaying letter sound prompts or words in a large, clearly legible font. Assessors recorded pupils' responses directly within the application by selecting one of three options: "correct," "incorrect," or "no response". The use of the digital platform enabled responses to be recorded and synchronised automatically with a central database, ensuring efficient data collation and reducing the risk of transcription errors.

Assessments were conducted by trained assessors who included government education officials, project intervention staff and academic researchers with prior experience in

administering pupil assessments. Before fieldwork commenced, all assessors participated in a structured training process designed to standardise assessment procedures.

Training materials included detailed written guidance and instructional videos demonstrating correct administration of the assessments. Assessors were required to familiarise themselves with the correct responses to all test items and to practice administering the assessments prior to visiting schools. The training videos also provided guidance on establishing a comfortable and appropriate assessment environment for children, as well as procedures for randomly sampling classes and pupils within each school.

Participation in the study was voluntary. Before each assessment session, pupils were informed by the assessor that they could decline participation or discontinue the assessment at any time. School leadership, including head teachers and class teachers were informed about the purpose and procedures of the research prior to data collection. Permission to conduct the study was granted by the Nigerian government and schools communicated information about the assessment to parents and guardians. Parents were informed that the purpose of the assessment was to examine the pupils' language and literacy development, that participation was voluntary and that all collected data would remain confidential and used solely for research purposes. Ethical approval was gained from Newcastle University's ethical board.

2.4 Statistical Analysis

Bivariate correlations were calculated to examine associations between phonemes and word scores within and across languages. These correlations provide an initial exploration of the relationships between Hausa (L1) and English (L2) test scores.

Because the dataset has a hierarchical structure, with pupils nested within schools and schools nested within states within northern Nigeria, multilevel modelling was conducted using Stata (Version 19). This approach allows the analysis to account for clustering effects at the pupil, school and region levels, providing more accurate estimates of the relationships among variables and the amount of score variation that is seen at the pupil level.

To further examine the structural relationships between these test scores Structural Equation Modelling (SEM) was employed in Stata. SEM is used to model the relationships between phonemes and word test scores in Hausa (L1) and English (L2). Allowing for the testing of potential bidirectional pathways between the two languages. Feedback path models were constructed to explore whether literacy skills in one language predicted outcomes in the other language, consistent with theoretical perspectives such as the Linguistic Interdependence Hypothesis and were these related to the pedagogy of classroom instruction.

To investigate the pedagogy of classroom instruction a binary variable was created with '1' defining pupils enrolled in classrooms where teachers use a translanguaging pedagogy for language learning and '0' were pupils attend a classroom where the pedagogy is a monoglossic approach to language learning.

Together, this statistical analysis were used to address the study's three research questions:

1. Are there associations between phoneme awareness and decoding scores within and across L1 (Hausa) and L2 (English) and are these related to classroom pedagogy?

2. Is there evidence of a bidirectional relationship between L1 (Hausa) and L2 (English) decoding skills, consistent with the *Interdependence Hypothesis* and are these related to classroom pedagogy?
3. To what extent is variation in test scores explained by classroom pedagogy at the pupil, school and state levels?

3. Results

Descriptive statistics were first calculated to examine the distribution of test score outcomes among the sample of 4,762 pupils**.** Mean scores and standard deviations were computed for sounds (phonemes) and word (reading decoding) assessments in both Hausa (L1) and English (L2) (Table 1).

Table 1. Means and standard deviations

Total test scores	**Hausa Sounds** (Phonemes)	**Hausa Word** (Reading Decoding)	**English Sounds** (Phonemes)	**English Word** (Reading Decoding)
Mean score (SD)	24.08 (8.266)	22.077 (12.351)	30.015 (9.001)	20.689 (11.703)
Skewness	-0.639	-0.209	-0.719	-0.009
Kurtosis	-0.242	-1.243	-0.165	-1.209
Translanguaging Pedagogy				
Mean score (SD)	24.213 (8.060)	22.684 (12.542)	30.048 (9.585)	22.196 (12.000)
Skewness	-0.658	-0.225	-0.831	-0.198
Kurtosis	-0.068	-1.250	-0.016	-1.235
Monoglossic Pedagogy				
Mean score (SD)	24.020 (8.358)	21.801 (12.254)	30.000 (8.723)	20.002 (11.502)
Skewness	-0.629	-0.204	-0.650	0.072
Kurtosis	-0.315	-1.242	-0.296	-1.159

Prior to conducting inferential analyses, the distributional properties of the test scores were examined to assess normality. As shown in Table 1 all variables fell within acceptable ranges for univariate normality. Specifically, skewness values between −1.0 and +1.0 indicated approximately symmetric distributions while kurtosis values between 0 and −1.5 were within acceptable limits, suggesting that the data were suitable for parametric statistical analysis (Burdenski, 2000; Gravetter and Wallnau, 2014).

Research question one

"Are there associations between phoneme awareness and decoding scores within and across L1 (Hausa) and L2 (English) and are these related to classroom pedagogy?"

The bivariate correlations between Hausa (L1) and English (L2) test scores are shown in Table 2 and Table 3. Carrying out bivariate Pearson correlations to examine the effect size associations between L1 (Hausa) and L2 (English) test scores demonstrates that they are all large ($r > 0.5$) and strongly positively significantly correlated in both types of learning environments.

Table 2 Translanguaging: Bivariate correlations

	Hausa Sounds (L1)	Hausa Words (L2)	English Sounds (L1)	English Words (L2)
Hausa Sounds (L1)	1			
Hausa Words (L1)	0.789**	1		
English Sounds (L2)	0.634**	0.598**	1	
English Words (L2)	0.630**	0.761**	0.743**	1

**Correlation is significant at the 0.01 level (2-tailed)

Table 3 Monoglossic: Bivariate correlations

	Hausa Sounds (L1)	Hausa Words (L2)	English Sounds (L1)	English Words (L2)
Hausa Sounds (L1)	1			
Hausa Words (L1)	0.740**	1		
English Sounds (L2)	0.636**	0.592**	1	
English Words (L2)	0.631**	0.744**	0.648**	1

**Correlation is significant at the 0.01 level (2-tailed)

Research question two

"Is there evidence of a bidirectional relationship between L1 (Hausa) and L2 (English) decoding skills, consistent with the *Interdependence Hypothesis* and are these related to classroom pedagogy?"

To examine the structural relationships between Hausa (L1) and English (L2), Structural Equation Modelling (SEM) was conducted using Stata (Version 19). Path analysis is a specific application of Structural Equation Modelling (SEM). A SEM is based on the analysis of covariance structures. The just identified feedback path model is used to show the effect of the word score for L1 (Hausa) on L2 (English) and vice versa (Kenny, 1979; Kline, 2016; Loehlin and Beaujen, 2017; Humble, 2020).

This structure allowed the model to evaluate whether cross language associations were unidirectional (L1 → L2 and L2 → L1), bidirectional (L1 ↔ L2), or nonsignificant, providing a direct test of the study's theoretical assumptions regarding cross language transfer. Cross language paths were then specified between Hausa (L1) and English (L2) word scores to test potential bidirectional transfer effects in the two different pedogeological classroom settings (Dixon et al., 2025; Humble et al., 2024).

The models were also designed to test potential bidirectional relationships between L1 (Hausa) and L2 (English) letter sound knowledge (phonemes), consistent with the Linguistic Interdependence Hypothesis proposed by Cummins (1979; 2000).

The feedback path model includes four observed variables representing pupils' literacy performance:

- Hausa phonemes (letter sound knowledge)

- Hausa word (reading decoding)
- English phonemes (letter sound knowledge)
- English word (reading decoding)

As shown in both Figure 1 and Figure 2 the data demonstrate a good fit to the model and reveal degrees of cross-linguistic relationships among the variables that are consistent with the interdependence framework. In translanguaging classrooms, 27% of the variance in L1 (Hausa) word scores and 30% in L2 (English) word scores remained unexplained. The disturbance in L1 (Hausa) and L2 (English) word scores are not significantly correlated (r_t =-0.11, p>0.05).

When English and Hausa are taught through a monoglossic pedagogy, 29% of the variation in L1 (Hausa) word scores and 41% in L2 (English) word scores remain unexplained by this model. The disturbance between L1 (Hausa) and L2 (English) word scores do not correlate (r_m =-0.087, p<0.05). Further comparison of the two models shows a significant difference in the unexplained variance for L2 (English) word (χ^2 (1) = 39.27, p<0.001), indicating greater unexplained variation in monoglossic classrooms than in translanguaging classrooms.

The exact solution demonstrates significant bivariate correlations between L1 (Hausa) phonemes and L2 (English) phonemes scores in both models (r_m =0.63; r_t =0.64, p<0.001), suggesting a strong positive association between these scores in both pedological different classrooms.

The path feedback analysis illustrates that L1 (Hausa) word predicts L2 (English) word and L2 (English) word predicts L1 (Hausa) word supporting Cummins' interdependence hypothesis (Table 4). Overall, the results demonstrating that cross language transfer is taking place in both classroom pedagogy settings.

The path from L1 (Hausa) word to L2 (English) word was significantly stronger across the translanguaging model (χ^2 (1) = 5.23, p<0.5). Conversely, the path from L2 (English) word to L1 (Hausa) word was stronger in monoglossic classrooms (χ^2 (1) = 4.58, p<0.05). In translanguaging instructional settings phoneme to word pathways were significantly stronger in L1 (Hausa), but not in L2 (English). Results demonstrate significant differences in L1 (Hausa) phonemes to L1 (Hausa) word (χ^2 (1) = 6.36, p<0.05), whereas the L2 (English) phonemes to L2 (English) word pathways did not (χ^2 (1) = 2.23, p>0.05) (Table 4)

Figure 1 Translanguaging - Path diagram

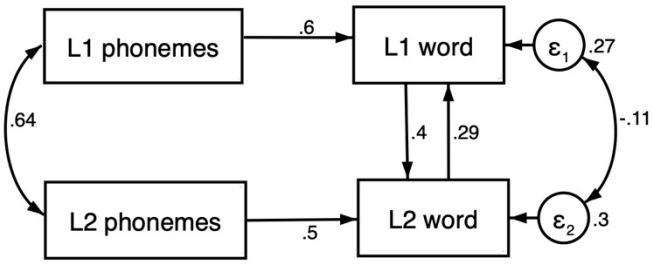
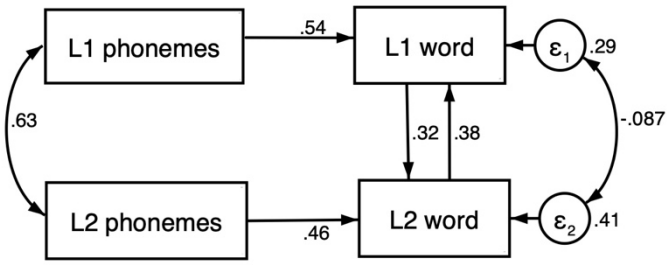


Figure 2 Monoglossic - Path diagram



These findings reflect associations rather than causal relationships. However, such associations are generally considered a necessary precondition for causal inference (Bollen, 1989). The observed patterns are consistent with Cummins' interdependence framework.

Table 4 Regression standardised structural coefficients for path diagram.

	Endogenous variables				chi-squared test of equality of the standardized coefficients
	Translanguaging		**Monoglossic**		
Exogenous variables	L1 word	L2 word	L1 word	L2 word	
L1 phonemes	0.604*** (0.022)		0.536*** (0.023)		χ^2 (1) = 6.36, p<0.05
L1 word		0.401*** (0.027)		0.323*** (0.024)	χ^2 (1) = 5.23, p<0.05
L2 phonemes		0.499*** (0.021)		0.459** (0.017)	χ^2 (1) = 2.23, p>0.05
L2 word	0.294*** (0.032)		0.384*** (0.023)		χ^2 (1) = 4.58, p<0.05

*** p<0.001. Number of observations 4762. L1 (Hausa) and L2 (English)

Research question three

"To what extent is variation in test scores explained by classroom pedagogy at the pupil, school and state levels?"

A multilevel linear mixed effects model was estimated to determine to what extent is the variation in test scores explained by classroom pedagogy - translanguaging versus monoglossic by differences at the pupil, school and state levels (Goldstein, 2003).

Pupils were nested within schools, which were nested within states. To account for this hierarchical structure, random intercepts were specified for both states and school. The fixed effects predictors included English (L2) word, English (L2) sounds, Hausa (L1) word, Hausa (L1) sounds, with variables controlling for pupil age, gender, the use of English at home and pre-primary attendance. In addition, random slopes were estimated at the school level for age, English use at home, pre-primary education and gender to allow the effects of these predictors to vary across schools.

The multilevel model has three levels (i) state (13 in total) (ii) school (828 in total) (iii) pupil (4762 in total). Comparing the base case with the final model shows how much of the variation in the word score achievement across school and state is accounted for. Explanatory independent variables are introduced into the model to try and explain part of the variability in the word score across schools and states. The residual variance is much lower in the final model than in the base model. The residual variance is lower because the state and school variances are partly explained by the introduction of these variables.

In this model, the total variance in the Hausa (L1) word (reading) score is equal to 29.212+17.056+0.063=46.331 (Table 5). The multilevel modelling illustrates that 63.1% of the variance is at the pupil level (29.212/46.331). This multilevel modelling result indicates that the majority of the variation in scores is attributable to the pupil level. Around one third of the variation in Hausa (L1) word reading score is due to the school (36.8%) and only 0.1% due to the state in which the school is situated. The total variance in the English (L2) word (reading) score is equal to 28.260+13.537+0.241=42.038. Therefore 67.2% of the variance is at the pupil level, 32.2% at the school level and 0.6% at the state level.

The multilevel modelling analysis gives four independent variables that have a positive significant effect. Hausa (L1) word (reading) score is significantly predicted through Hausa (L1) sound ($B=0.565$, $p<0.001$) and English (L2) word ($B=0.540$, $p<0.001$) scores. Similarly, English (L2) word score is significantly predicted through Hausa (L1) word ($B=0.555$, $p<0.001$) and English sound ($B=0.407$, $p<0.001$) scores.

A multilevel mixed effects model was estimated to examine predictors of English (L2) and Hausa (L1) word scores (Table 5). Comparisons between instructional contexts, of translanguaging and monoglossic, revealed statistically significant patterns consistent with those observed in the feedback path model after adjusting for covariates. Controlling for pupil demographics of age and gender, use of English at home and pre-primary education, the multilevel modelling results replicated the bidirectional relationship identified in the path analysis. That is L1 (Hausa) word scores significantly predicted L2 (English) word scores and L2 (English) word scores significantly predicted L1 (Hausa) word scores, providing further support for Cummins' interdependence hypothesis.

Table 5 Multilevel model for English and Hausa test scores

Dependant variable	Hausa (L1) word score (reading decoding)				English (L2) word score (reading decoding)			
	Translanguaging		**Monoglossic**		**Translanguaging**		**Monoglossic**	
	Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE
Base Case								
Intercept	22.118***	1.710	22.027***	1.211	21.445***	1.708	20.035***	0.939
Pupil variance	52.168	2.105	47.194	1.286	41.615	1.677	38.945	1.061
School variance	85.908	9.167	92.038	6.246	78.158	8.136	93.347	6.181
State variance	30.229	16.361	16.406	7.431	30.891	15.502	8.843	4.646
Final Model								
Pupil variance	26.885	1.117	26.370	0.792	20.638	0.942	23.057	0.645
Hausa phoneme score	0.726***	0.021	0.622***	0.020				
Hausa word score					0.392***	0.018	0.433***	0.013
English word score	0.432***	0.021	0.469***	0.014				
English phoneme score					0.536***	0.026	0.448***	0.018
English at home	0.118	0.462	-0.255	0.325	0.101	0.462	0.616	0.335
Pre-primary education	0.500	0.407	0.388	0.286	0.367	0.460	0.349	0.290
Gender (Female=1)	-0.511	0.281	-0.253	0.197	-0.185	0.279	0.163	0.178
age	0.575***	0.146	0.438***	0.098	0.365*	0.143	0.138	0.098
School variance	4.899	4.760	15.299	1.683	0.673	4.691	27.858	2.179
State variance	1.132	0.968	2.428	1.164	5.595	3.607	1.573	0.976

4762 pupils, 828 schools and 13 states. Translanguaging: 1476 pupils, 247 schools, and 13 states; monoglossic: 3286 pupils, 584 schools and 13 states ***p< 0.001, **p<0.01, *p<0.05

Chi-squared test of equality of significant coefficients; Hausa phoneme score χ^2 (1) = 7.12, p>0.001; Hausa word score χ^2 (1) = 2.23, p>0.05; English word score χ^2 (1) = 2.54, p>0.05; English phoneme score χ^2 (1) = 5.73, p>0.05

The effects were stronger in the monoglossic settings, for L2 (English) word to L1(Hausa) word (χ^2 (1) = 2.54, p>0.05) and L1 (Hausa) word to L2 (English) word scores (χ^2 (1) = 2.23, p>0.05), but neither statistically significantly different due to setting. In contrast, phoneme to word relationships were stronger in translanguaging instructional settings and statistically significantly different. As we have seen in the path model phonemes, both L1 (Hausa) and L2 (English), demonstrate significantly greater effects on word scores in translanguaging settings. L1 (Hausa) phonemes on L1 (Hausa) word were statistically significantly greater in translanguaging classroom settings (χ^2 (1) = 7.12, p<0.001). Similarly, the effect of L2 (English) phonemes on L2 (English) word score demonstrate stronger associations (χ^2 (1) = 5.73, p<0.05) in translanguaging classrooms.

Concerning the total variance the Hausa (L1) word (reading) score is equal to 26.885 +4.899 +1.132=32.916 for translanguaging instruction and 26.370+15.299+2.428=44.097 for monoglossic instruction (Table 5). The multilevel modelling illustrates that 81.678% of the variance is at the pupil level (26.885/32.916) in the translanguaging instruction as opposed to (26.370/44.097) only 59.800% in pupil variance in the monoglossic instruction. This multilevel modelling result indicates that the majority of the variation in scores is attributable to the pupil level in translanguaging classroom.

The total variance in the English (L2) word (reading score) is equal to 20.638+0.673+5.595 = 26.906 for translanguaging instruction and 23.057+27.858+1.573 = 52.488 for monoglossic

instruction. Therefore 76.704% of the variance is at the pupil level, in the translanguaging classroom as opposed to only 43.928% variance in the monoglossic instructional environment.

The variance partitioning results indicate marked differences in the distribution of variance across levels between the two instructional contexts. Although the sample sizes differ with translanguaging and monoglossic instructional groups, both are sufficiently large that sampling variability is minimal. With large samples, sampling variability in variance estimates is reduced as the sampling distribution of the variance becomes increasingly concentrated around the population value. The observed variance difference in these data is therefore unlikely to be a product of sample size and instead reflects a substantive difference in variability between the groups (Wasserman, 2004; Casella and Berger, 2002).

For English (L2) word reading scores, the majority of variance in translanguaging classrooms was located at the pupil level (73.72%; 21.366/28.983), compared to only 44.10% (22.682/51.434) in monoglossic instructional environment, indicating substantially greater clustering by school and state in the latter. A similar pattern was observed for Hausa (L1) word reading, where pupil level variance accounted for 84.97% of total variance in translanguaging classrooms, compared to 59.16% in monoglossic settings. Across both outcomes translanguaging classrooms exhibited markedly reduced higher level variance, suggesting a weaker influence of institutional context on pupil outcomes.

These findings could imply that using a translanguaging pedagogy in classrooms may reduce school and state differences. This implies that institutional differences around schools and state location matter less when using a translanguaging pedagogy compared to a monoglossic one. The result also could imply that translanguaging classroom pedagogy is creating a more consistent learning environment for the students across contexts. Producing a more context independent distribution of outcomes, whereas in classrooms that have adopted monoglossic literacy practices, institutional and regional contexts are playing a more noticeable role in shaping score variation.

Across multiple outcomes, the findings demonstrate that translanguaging classrooms are associated with a substantially greater proportion of variance at the pupil level and reduced variance attributable to schools and states. These results suggest that translanguaging literacy practices may help reduce between school and regional disparities, leading to a more equitable distribution of educational outcomes. Policymakers could therefore consider supporting the adoption and scaling of translanguaging pedagogies as part of broader strategies aimed at reducing structural inequalities within education systems.

4. Discussion

The present study set out to examine the nature of cross linguistic relationships between Hausa (L1) and English (L2) literacy skills and to explore how these relationships vary across different instructional contexts. Across all analyses, the findings provide consistent evidence of strong, positive associations between L1(Hausa) and L2 (English) phonemes scores and word decoding, offering robust support for cross linguistic transfer and the broader theoretical framework of linguistic interdependence. The bivariate correlations revealed large and statistically significant relationships between Hausa (L1) and English (L2) literacy measures in both translanguaging and monoglossic literacy instructional settings. These findings indicate that learners who demonstrate stronger skills in one language also tend to perform better in the other, particularly in phoneme sounds and word decoding. Such patterns are consistent with

Cummins' *Linguistic Interdependence Hypothesis*, showing that underlying cognitive and linguistic proficiencies are shared across languages (Cummins, 1981; Cummins, 2017; Cummins, 2021).

These findings also align with cross linguistic research demonstrating that literacy related skills such as sound and word decoding are not language specific but draw on shared cognitive processes (Koda, 2007; Koda, 2012). Similar evidence of cross language transfer has been observed in multilingual contexts, including recent work in Nigerian primary schools (Humble et al., 2024; Dixon et al., 2025), reinforcing the generalisability of these patterns across linguistic and educational settings.

Importantly, these associations were remarkably stable across pedagogical contexts, suggesting that cross language relationships are not contingent on a single instructional approach. Instead, they appear to reflect underlying cognitive linguistic processes that support literacy development across languages.

The feedback path models demonstrated that Hausa (L1) word reading significantly predicts English (L2) word reading, and vice versa, providing empirical support for reciprocal transfer rather than a strictly unidirectional model. This finding is consistent with theoretical and empirical work suggesting that bilingual learners draw flexibly on their full linguistic repertoire when developing literacy (Cummins, 2017; García and Wei, 2013).

Although some differences in path strength were observed across instructional contexts, these were relatively small. There was some indication that L1(Hausa) to L2 (English) transfer may be slightly stronger overall, while L2 (English) to L1 (Hausa) effects were more pronounced in monoglossic classrooms. However, the general pattern across both models supports a dynamic, bidirectional system of literacy development, consistent with contemporary understandings of bilingual cognition (Bialystok et al., 2012).

The phoneme to word pathways also provide insight into the mechanisms underpinning literacy acquisition. In translanguaging classrooms, L1 (Hausa) phoneme sound scores showed a significantly stronger relationship with L1 (Hausa) word decoding, suggesting that integrated language use may reinforce foundational skills in the first language. This aligns with research highlighting the importance of strong L1 (Hausa) foundations for successful literacy development (Sparks and Ganschow, 1993).

One of the most notable findings from the multilevel modelling analysis concerns the proportion of unexplained variance. The model accounted for more variance in English (L2) word reading outcomes in translanguaging literacy classroom settings compared to monoglossic settings, where substantially more unexplained variance remained. This suggests that institutional and contextual factors play a larger role in shaping literacy outcomes when languages are taught separately. From a theoretical perspective, translanguaging provides a useful lens for interpreting this pattern. Translanguaging approaches conceptualise bilingualism as an integrated system rather than two separate linguistic codes (García, 2009; Otheguy et al., 2015; Wei, 2017). The reduced unexplained variance may therefore reflect a more coherent learning environment in which learners can leverage shared linguistic resources more effectively.

In contrast, the higher unexplained variance in L2 (English) outcomes in monoglossic classrooms may indicate that additional unobserved factors, such as variability in instructional

sequencing or reduced opportunities for cross language connections play a greater role when languages are taught separately. This interpretation is consistent with research on multilingual education in African contexts, which highlights the challenges of rigid language separation policies (Heugh, 2011; Trudell, 2023; Benson, 2019).

These findings have important implications for educational equity. The reduced between school and state variance observed in translanguaging classrooms suggests that this approach may mitigate structural inequalities by producing more consistent outcomes across different contexts. This aligns with broader evidence that bilingual and dual language models can support more equitable educational outcomes (Thomas and Collier, 2012; Collier and Thomas, 2002).

Within the African context, where language of instruction policies often vary widely across regions and schools, translanguaging may offer a practical and context responsive approach to multilingual education (Bamgbose, 2004; Heugh, 2011; Omidire, 2026). By allowing learners to draw on both Hausa (L1) and English (L2) simultaneously, such approaches may reduce the dependence of learning outcomes on institutional resources or policy implementation differences.

5 Limitations, Implications and future research

Despite these contributions, several limitations should be acknowledged. First, the analyses are based on observational data and therefore causal inferences cannot be drawn. While the presence of strong associations is consistent with cross linguistic transfer, it does not establish the direction or mechanism of causality (Bollen, 1989; Kenny, 1979).

Second, the models include a limited set of observed variables and may omit relevant factors such as instructional quality, teacher practices or learner motivation. The unexplained variance in some models suggests that additional variables could further refine understanding of literacy development.

Third, while the categorisation of instructional contexts captures broad pedagogical differences, there may be considerable variation within these categories that is not fully accounted for in the analysis.

Taking these limitations into account the findings still have important implications for both theory and practice. From a theoretical perspective, the results provide strong empirical support for the *Linguistic Interdependence Hypothesis* and extend it by demonstrating bidirectional transfer across languages in a large scale context. From a policy and practice perspective, the results suggest that translanguaging pedagogical approaches may offer advantages in promoting more equitable literacy outcomes. By reducing the influence of school and state level factors, such approaches may help ensure that learning outcomes are less dependent on institutional context.

Future research should build on these findings by employing longitudinal or experimental designs to better establish causal mechanisms. Further work is also needed to explore how specific classroom practices within translanguaging approaches contribute to these effects and whether similar patterns are observed in other multilingual and African language contexts.

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Informed Consent Statement

Informed consent was obtained from all subjects involved in the study.

Data Availability Statement

The data presented in this study are available from Newcastle University's open repository (data.ncl).

Conflicts of Interest

Author L.G. was employed by the company Universal Learning Solutions. The remaining authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.