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Phonological Contributors to Delayed Progress in Key Stage 2 Readers

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ABSTRACT

This study examined the phonological contributors to delayed reading progress among Key Stage 2 learners in the public elementary schools of the Paniqui West District. It used a quantitative, non-experimental correlational-comparative design involving 100 Grades 4 to 6 learners divided into matched groups of readers with delayed progress and typically progressing peers. Participants completed an individually administered battery measuring phonological awareness, rapid automatized naming, phonological memory, oral reading fluency, word-reading accuracy, reading comprehension, and non-verbal competency. Data were analyzed through simple linear regression, independent-samples group comparisons, and hierarchical multiple regression. Phonological awareness strongly and uniquely predicted reading fluency ($\beta = .58$, $p < .001$) and accounted for 33.6% of its variance. Delayed readers demonstrated a significant triple deficit in phonological awareness, processing speed, and phonological memory. Phonological awareness was the strongest predictor of word-reading accuracy ($\beta = .48$, $p < .001$), while slower rapid automatized naming also made a significant contribution ($\beta = -.26$, $p = .015$); together, the predictors explained 56.8% of the variance. After non-verbal competency was controlled, the composite phonological processing score explained an additional 13.2% of the variance in reading comprehension. The findings indicate that persistent phonological weaknesses create an accuracy and automaticity bottleneck that increases cognitive load and limits comprehension. Intensive, explicit, and multi-component phonological remediation is therefore necessary for older struggling readers.

Keywords: *phonological awareness, rapid automatized naming, phonological memory, reading fluency, reading comprehension, Key Stage 2*

INTRODUCTION

Reading development depends on the increasingly automatic coordination of sound awareness, symbol recognition, word decoding, fluency, and meaning construction. Phonological awareness is particularly important because it enables learners to identify, segment, blend, and manipulate speech sounds and to connect these sounds with written symbols. Although this skill is usually emphasized in the early grades, unresolved weaknesses may continue to restrict the reading development of older learners, especially those who still decode slowly and inaccurately (Stanovich, 1988; Zugarramurdi et al., 2022).

The contribution of phonological processing is not limited to awareness of individual sounds. Rapid automatized naming (RAN) reflects the speed with which familiar visual symbols can be accessed and verbalized, while phonological memory supports the temporary storage of sound sequences during decoding. Research has shown that slow naming, weak phonological memory, and inefficient orthographic retrieval may distinguish struggling readers even when basic instruction has already been provided (Cheah et al., 2023; Robinson &

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Meisinger, 2022). These component skills are therefore important when examining why some Key Stage 2 learners remain delayed despite years of schooling.

Reading difficulties are further complicated in multilingual environments. Learners may encounter the relatively transparent sound-symbol relationships of Filipino together with the more irregular orthography of English and local language influences. Cross-linguistic transfer can support literacy when phonological and orthographic patterns are compatible, but competing rules can also increase processing demands (Huang et al., 2025; Kopecková et al., 2023). Consequently, the causes of delayed progress cannot be assumed from surface-level fluency scores alone; a diagnostic profile is needed to identify whether the main weakness lies in phonological awareness, processing speed, memory, or their combined effects.

In the Paniqui West District, some Grades 4 to 6 learners continued to perform below expected reading levels. Most remediation programs for older struggling readers emphasize repeated reading or comprehension practice, yet such approaches may not fully address unresolved decoding mechanisms. The source study therefore investigated the unique predictive contribution of phonological awareness to reading fluency, compared the phonological profiles of delayed and typically progressing readers, determined the relative contributions of phonological awareness and processing speed to word-reading accuracy, and assessed the unique contribution of a composite phonological score to reading comprehension after non-verbal competency was controlled.

The study addressed a practical and empirical gap by examining older readers in a real public-school context rather than focusing only on beginning readers or highly controlled clinical groups. Its findings provide a basis for targeted screening and remediation that can distinguish between accuracy, automaticity, and memory-related weaknesses. Such evidence is essential for designing interventions that resolve the mechanical sources of reading difficulty and allow learners to devote more cognitive resources to comprehension.

Literature Review

Phonological Awareness and the Core Deficit in Reading

The Phonological Core Deficit Theory proposes that persistent reading disability is primarily rooted in weaknesses in representing, accessing, and manipulating the sound structure of language (Stanovich, 1988). When learners cannot segment or blend phonemes efficiently, grapheme-phoneme correspondence remains effortful, word recognition does not become automatic, and reading fluency develops slowly. This mechanism helps explain why learners with otherwise adequate non-verbal reasoning may still experience severe reading difficulty.

Evidence across alphabetic writing systems generally supports the foundational role of phonological awareness, although the strength of its contribution varies according to orthographic transparency. Zugarramurdi et al. (2022) found that the contribution of prereading phonological awareness should be interpreted in relation to the structure of the orthography. In deep orthographies such as English, inconsistent letter-sound relationships place greater demands on phonological analysis and repeated mapping, making unresolved sound-awareness deficits especially consequential.

Among older struggling readers, phonological weakness may persist together with word- and text-level difficulties. Meisinger et al. (2022) documented the coexistence of decoding and text-reading problems among students with dyslexia, while Robinson and Meisinger (2022) found that phonological processing was related to oral and silent reading fluency. These findings support continued assessment of phonological skills beyond the primary grades rather than assuming that older learners have already mastered them.

Processing Speed, Phonological Memory, and Reading Automaticity

Fluent reading requires not only accurate sound analysis but also rapid access to phonological labels. RAN tasks measure how efficiently learners retrieve the names of familiar letters, numbers, colors, or objects. Slow performance reflects weak automaticity in the visual-to-verbal pathway and can limit reading rate even when basic decoding is possible. Cheah et al. (2023) identified RAN and orthographic-processing weaknesses among poor Chinese-English spellers, illustrating that literacy delay may involve a broader automaticity problem rather than an isolated phoneme deficit.

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Phonological memory supports the temporary retention and sequencing of sounds during word analysis, vocabulary learning, and sentence processing. Teng (2023, 2024, 2025) consistently showed that phonological working memory contributes to vocabulary acquisition and retention under different learning conditions. For struggling readers, weak temporary storage may cause the initial sounds or syllables of a word to fade before later parts are decoded, resulting in fragmented recognition and reduced accuracy.

Automaticity and memory are therefore complementary to phonological awareness. RAN reflects how quickly sound labels can be retrieved, whereas phonological memory determines how effectively they can be maintained and combined. A learner may understand sound segmentation but still read slowly because retrieval is inefficient, or may retrieve individual sounds quickly but lose their sequence in longer words. A profile-based approach is needed to identify these distinct yet interacting sources of difficulty.

Orthographic, Multilingual, and Learner-Specific Influences

Phonological skills operate together with orthographic learning. Ye et al. (2021, 2022) found that copying and orthographic-memory skills made unique contributions to Chinese spelling development, while Cho (2021) showed that copying fluency predicted Korean word reading and spelling. McDonald et al. (2024) likewise demonstrated that early name writing contributed to later literacy outcomes. These studies indicate that efficient reading requires the consolidation of stable visual word patterns in addition to accurate phonological decoding.

Multilingual and diglossic settings may either facilitate or complicate this consolidation. Huang et al. (2025) reported that Mandarin-Cantonese diglossia influenced children's phonological and morphological awareness, while Kopecková et al. (2023) demonstrated cross-linguistic phonological influence during additional-language acquisition. Explicit instruction can help learners use similarities across languages while avoiding interference from conflicting sound-symbol rules; Shi (2023), for example, found benefits from targeted metalinguistic instruction in Chinese learning.

The expression of phonological difficulty also differs across learner groups. Adapted phonological interventions produced only modest gains for some learners with Down syndrome (Hessling Prahl et al., 2022), and Roepke et al. (2025) showed that inconsistent phonological disorder may require support beyond conventional phonological exercises. For deaf and hard-of-hearing readers, alternative phonological representations and lexical knowledge may be especially important (Antia et al., 2020; Olujic Tomazin et al., 2025). These findings reinforce the need for differentiated intervention based on a learner's complete profile.

Phonological Processing, Cognitive Load, and Comprehension

Reading comprehension depends on the availability of cognitive resources for building meaning, drawing inferences, monitoring coherence, and integrating information. When word recognition is slow and inaccurate, attention and working memory are consumed by decoding. The learner may successfully identify individual words but have insufficient capacity left to connect ideas across a sentence or passage. Persistent phonological inefficiency can therefore influence comprehension indirectly through cognitive load.

Robinson and Meisinger (2022) observed that phonological processing was more consistently related to fluency than directly to comprehension, suggesting that its effect on meaning-making is mediated by reading efficiency. Similarly, Olujic Tomazin et al. (2025) emphasized the importance of broader linguistic knowledge for text comprehension. These findings do not diminish the role of phonological processing; rather, they indicate that phonological skill provides the mechanical foundation that permits vocabulary and language comprehension to operate effectively.

The present study therefore treated non-verbal competency as a control variable and examined whether the composite phonological score explained additional variance in comprehension. This approach tested whether reading difficulty remained associated with phonological processing even after differences in general reasoning were accounted for. The conceptual model in Figure 1 summarizes the primary proposed relationship: phonological awareness uniquely predicts reading fluency, while the broader analyses extend the model to processing speed, memory, accuracy, and comprehension.

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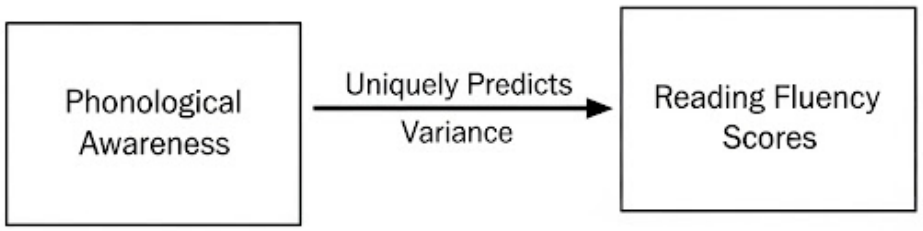

Figure 1. *Paradigm of the study*

METHODS

Research Design

The study employed a quantitative, non-experimental design that combined correlational, comparative, and predictive approaches. Simple regression was used to determine the unique contribution of phonological awareness to reading fluency. Comparative analysis examined differences in the phonological processing profiles of delayed and typically progressing readers, while hierarchical regression assessed the relative contributions of phonological awareness and processing speed to word-reading accuracy and the additional contribution of composite phonological processing to comprehension after non-verbal competency was controlled.

Research Locale

The research was conducted in public elementary schools in the Paniqui West District. The district served learners with varied linguistic and educational backgrounds and contained sufficient numbers of Grades 4 to 6 learners for the formation of matched comparison groups. School and district authorities supported the individual assessment procedures required for the study.

Participants and Sampling Technique

Participants were selected purposively through a criterion-based comparative group procedure. Reading coordinators and Grades 4 to 6 teachers assisted in identifying learners whose recent reading assessments and classroom performance indicated either delayed progress or typical progress. The final analytic sample consisted of 100 learners, with 50 readers in each group, as reflected in the group-comparison degrees of freedom. The two groups were matched by grade level to strengthen the validity of the comparison.

Research Instruments

Data were obtained through an individually administered comprehensive phonological and reading skills battery. Phonological awareness was measured through phoneme deletion, phoneme blending, and rhyme-detection tasks. Processing speed was assessed through a rapid automatized naming task, while phonological memory was measured through digit-span and nonword-repetition activities. Oral reading fluency was expressed as words correct per minute, and word-reading accuracy was based on the percentage of correctly read real words and pseudowords.

Reading comprehension was measured through a grade-appropriate passage followed by literal, inferential, and main-idea questions. A standardized non-verbal competency measure, identified in the source study as a Raven's Progressive Matrices- or TONI-type test, generated the control score used in the final hierarchical model. The source manuscript described the battery as standardized and norm-referenced and indicated that all subtests were administered according to established procedures.

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Data Gathering Procedure

After institutional and school permissions had been secured, a larger pool of Key Stage 2 learners was screened using school reading results and an oral reading fluency measure. Eligible learners were classified into delayed-progress and typically progressing groups. Written parental consent and learner assent were obtained before assessment. Each participant completed the phonological, reading, and non-verbal measures individually in a quiet school setting under the guidance of a trained assessor. Scores were checked, coded with anonymous identifiers, and organized for statistical analysis.

Data Analysis

Simple linear regression tested whether phonological awareness uniquely predicted reading fluency. Independent-samples comparisons examined differences between the two reader groups in phonological awareness, RAN time, and phonological memory. Hierarchical multiple regression determined the relative effects of phonological awareness and RAN time on word-reading accuracy. A second hierarchical model entered non-verbal competency in Step 1 and the composite phonological score in Step 2 to determine the additional variance explained in reading comprehension. Statistical decisions were made at the .05 level of significance.

Before inferential analyses, the source study indicated that the data were screened for normality, homogeneity of variance, linearity, homoscedasticity, multicollinearity, and the assumptions required for comparative and regression procedures. These checks supported the use of the selected parametric analyses.

Ethical Considerations

The study observed institutional permission, written parental or guardian consent, and learner assent. Participation was voluntary, and the assessment activities were explained in age-appropriate language. Learners could pause or discontinue without penalty. To minimize stigma and anxiety, assessment sessions were conducted supportively and were presented as activities intended to understand how children learn to read rather than as graded examinations.

Participant identities were replaced with unique codes, and no identifying information was included in the reports. Data were stored in password-protected files and used only for the purposes of the research. The study was guided by confidentiality, non-maleficence, and beneficence, with the intended benefit of improving the diagnosis and remediation of persistent reading difficulties.

RESULTS AND DISCUSSION

Phonological Awareness as a Predictor of Reading Fluency

Table 1. *Unique prediction of reading fluency by phonological awareness*

Predictor	Outcome	Standardized β	p-value	R^2	Interpretation
Phonological awareness score	Reading fluency (WCPM)	0.58	< .001	0.336	Strong and significant unique predictor

Phonological awareness was a strong positive predictor of reading fluency ($\beta = .58$, $p < .001$), explaining 33.6% of the variance in words correct per minute. The null hypothesis was therefore rejected. The coefficient indicates that learners with stronger ability to isolate, blend, and manipulate speech sounds tended to read more fluently, and the proportion of explained variance shows that this relationship was educationally substantial rather than merely statistically significant.

The finding supports the Phonological Core Deficit Theory and confirms that an early foundational skill remained a major bottleneck among older struggling readers (Stanovich, 1988). Fluency requires rapid and largely automatic decoding; when sound analysis is incomplete, the learner must devote conscious effort to each word. This interpretation is consistent with longitudinal evidence connecting phonological processing with oral and

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silent reading fluency among learners with dyslexia (Robinson & Meisinger, 2022). Intervention for delayed Key Stage 2 readers should therefore include explicit rebuilding of phonological skills rather than relying exclusively on repeated-reading speed practice.

Differences in the Phonological Profiles of Delayed and Typical Readers

Table 2. *Phonological processing profiles of the two reader groups*

Measure	Group	Mean Z	SD	t	p-value
Phonological awareness	Typically progressing	0.65	0.88	-3.88	< .001
Phonological awareness	Delayed progress	-0.25	0.75	-3.88	< .001
RAN time (lower is faster)	Typically progressing	-0.55	0.60	3.20	.002
RAN time (lower is faster)	Delayed progress	0.35	0.95	3.20	.002
Phonological memory	Typically progressing	0.40	0.85	-1.99	.049
Phonological memory	Delayed progress	-0.10	0.70	-1.99	.049

The delayed-progress group performed significantly below the typically progressing group in all three phonological domains. For phonological awareness, the typical group obtained a mean Z score of 0.65 compared with -0.25 for the delayed group, $t(98) = -3.88$, $p < .001$. In RAN, the delayed group required more time ($M = 0.35$) than the typical group ($M = -0.55$), $t(98) = 3.20$, $p = .002$. Phonological memory was also weaker among delayed readers ($M = -0.10$) than their peers ($M = 0.40$), $t(98) = -1.99$, $p = .049$.

The pattern indicates a triple deficit involving sound awareness, retrieval speed, and temporary sound storage. The finding agrees with evidence that poor literacy performance may involve combined phonological and automaticity weaknesses (Cheah et al., 2023; Robinson & Meisinger, 2022). Although the difference in memory was smaller than the differences in awareness and speed, it remains instructionally important for decoding multisyllabic words and maintaining sound sequences. A single-strategy intervention is therefore unlikely to be sufficient; remediation should integrate phoneme-level instruction, timed naming practice, and memory-supported decoding activities.

Relative Contributions to Word-Reading Accuracy

Table 3. *Phonological awareness and processing speed as predictors of word-reading accuracy*

Predictor	B	Standardized β	p-value	Contribution
Phonological awareness	0.45	0.48	< .001	Strongest unique predictor
RAN time	-0.21	-0.26	.015	Weaker but significant predictor
Overall model	—	—	< .001	$R^2 = .568$; $F(2, 97) = 64.20$

Phonological awareness and RAN time jointly explained 56.8% of the variance in word-reading accuracy, $F(2, 97) = 64.20$. Phonological awareness was the stronger predictor ($\beta = .48$, $p < .001$), while slower RAN time contributed negatively and significantly ($\beta = -.26$, $p = .015$). The third null hypothesis was rejected because the two variables made unequal contributions, with sound-awareness skill exerting the larger unique effect.

The result clarifies the roles of accuracy and automaticity. Phonological awareness determines whether the learner can identify and combine the sound units needed to decode the word correctly, whereas RAN reflects the speed of retrieving the relevant verbal label. Automaticity research suggests that both mechanisms are necessary, but the larger coefficient for phonological awareness indicates that accurate sound analysis should be the initial priority. Timed retrieval work should follow and reinforce explicit phoneme manipulation rather than substitute for it.

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Unique Contribution to Reading Comprehension

Table 4. *Hierarchical regression predicting reading comprehension*

Step	Predictors entered	R^2	ΔR^2	F change	p-value
1	Non-verbal competency	0.283	0.283	38.50	< .001
2	Non-verbal competency + composite phonological score	0.415	0.132	22.10	< .001

Non-verbal competency alone explained 28.3% of the variance in reading comprehension. When the composite phonological processing score was added, the total explained variance increased to 41.5%. The phonological score therefore accounted for an additional 13.2% of unique variance, $\Delta R^2 = .132$, F change = 22.10, $p < .001$. The fourth null hypothesis was rejected.

The additional contribution demonstrates that comprehension difficulty could not be attributed only to general reasoning. Even learners with adequate non-verbal competency may struggle to construct meaning when decoding remains effortful. This finding is consistent with a cognitive-load interpretation: unresolved sound awareness, retrieval-speed, and memory problems consume resources needed for inference, monitoring, and integration. At the same time, the result should not be interpreted as suggesting that phonological processing is the sole determinant of comprehension. Vocabulary, language knowledge, and text-level skills remain necessary, but their effects are constrained when word recognition is inefficient (Olujic Tomazin et al., 2025; Teng, 2025).

Summary of Hypothesis Testing

Table 5. *Decisions on the null hypotheses*

Hypothesis	Null statement	Decision	Statistical basis
H01	PA does not uniquely predict reading fluency.	Rejected	$\beta = .58$; $R^2 = .336$; $p < .001$
H02	The groups do not differ in phonological processing.	Rejected	Significant differences in PA, RAN, and memory
H03	PA and processing speed do not differ in contribution to accuracy.	Rejected	PA $\beta = .48$; RAN $\beta = -.26$
H04	The composite score adds no unique comprehension variance.	Rejected	$\Delta R^2 = .132$; $p < .001$

All four null hypotheses were rejected. Across analyses, the findings consistently identified phonological awareness as the principal contributor to delayed reading progress, while RAN and phonological memory added important information about automaticity and processing capacity. The convergence of regression and group-comparison evidence strengthens the conclusion that delayed Key Stage 2 reading is associated with a multi-component phonological profile rather than a single observable fluency problem.

CONCLUSION

Delayed reading progress among the Key Stage 2 learners was strongly associated with unresolved phonological processing weaknesses. Phonological awareness uniquely explained one-third of the variance in reading fluency and was the strongest predictor of word-reading accuracy. Delayed readers also exhibited significantly weaker processing speed and phonological memory, establishing a triple-deficit profile that affected both correctness and automaticity. These results indicate that the learners' difficulty was not simply a lack of practice or general reasoning ability but a persistent weakness in the mechanisms required to decode and retain sound information.

The composite phonological score continued to explain reading comprehension after non-verbal competency was controlled. Thus, inefficient decoding created a cognitive bottleneck that prevented learners from using their reasoning resources fully for meaning-making. The study contributes a diagnostic basis for

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distinguishing sound-awareness, retrieval-speed, and memory deficits among older readers. Its central implication is that effective Key Stage 2 remediation must return to the phonological foundations of reading while integrating automaticity and memory support.

Recommendation

Schools should implement a comprehensive phonological screening process for struggling Grades 4 to 6 readers rather than relying only on overall fluency or comprehension results. Intervention should begin with intensive, explicit phoneme segmentation, deletion, blending, and grapheme-phoneme mapping; it should then incorporate structured RAN activities, cumulative decoding practice, and phonological-memory exercises. Progress monitoring should document accuracy, speed, and retention separately so instruction can be adjusted to the learner's dominant deficit.

Reading coordinators and teachers should receive training on the interpretation of phonological profiles and on age-appropriate remediation for older learners. Administrators should provide protected intervention time, suitable decodable and multisyllabic materials, and referral pathways for learners whose needs suggest more complex speech, language, or learning difficulties. Future studies may use longitudinal or experimental designs, include vocabulary and morphological awareness, and examine how Filipino-English sound-symbol differences influence intervention response.

Table 6. *Proposed multi-component phonological remediation framework*

Component	Core Action	Responsible Persons	Expected Indicator
Diagnostic profiling	Assess PA, RAN, memory, accuracy, fluency, and comprehension.	Reading coordinators, teachers	Individual phonological profile
Phonological awareness	Explicit segmentation, deletion, blending, and sound manipulation.	Reading teachers, SPED teachers	Improved PA and decoding accuracy
Automaticity	Timed but accuracy-controlled naming and repeated grapheme-sound retrieval.	Classroom and intervention teachers	Reduced RAN time and improved fluency
Phonological memory	Digit-span, syllable retention, nonword repetition, and cumulative blending.	Reading specialists	Improved retention of sound sequences
Transfer to text	Apply gains to multisyllabic words, connected reading, and comprehension.	Teachers and parents	Improved WCPM, accuracy, and meaning-making
Monitoring and referral	Review progresses every 4–6 weeks and refer persistent complex cases.	School head, reading team	Responsive adjustment and appropriate referral

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