Reading and Writing
https://doi.org/10.1007/s11145-026-10759-8

The role of vocabulary in reading efficiency in Spanish

Lydia García-Gómez[1] · Luis González-Fernández[2] · Mercedes I. Rueda-Sánchez[1]

Received: 17 July 2025 / Accepted: 1 January 2026

Abstract

This study explored the relationships between reading efficiency and metalinguistic awareness, reading fluency, and surface and deep vocabulary in 364 Spanish schoolchildren in 3rd, 4th, and 5th grades of primary school, using a Multiple Indicators, Multiple Causes (MIMIC) model within the framework of Structural Equation Modeling (SEM). The results suggested a notable direct association between metalinguistic awareness and word/pseudoword reading fluency and reading efficiency, and a smaller but potentially meaningful contribution of vocabulary. A direct association between reading fluency and vocabulary was also observed. Indirect associations were observed between reading fluency and reading efficiency through the potential mediation of vocabulary knowledge. Overall, phonological and morphological awareness appeared to have the greatest influence on reading efficiency, while both deep and shallow vocabulary may contribute to reading in a transparent orthography such as that of Spanish.

Keywords Deep vocabulary · Reading efficiency · Metalinguistic awareness · Reading fluency

✉ Lydia García-Gómez
lydia5@usal.es

Luis González-Fernández
lgf@usal.es

Mercedes I. Rueda-Sánchez
mirueda@usal.es

1 Department of Developmental and Educational Psychology, Faculty of Psychology, University of Salamanca, Salamanca, Spain

2 Department of Social Psychology and Anthropology, Faculty of Economics and Business, University of Salamanca, Salamanca, Spain

Published online: 16 January 2026

Introduction

Reading is a complex cognitive activity whose purpose is to understand written text. Some authors argue that reading involves understanding written language at the same level as the oral text (Sánchez, 2024). The Simple View of Reading (Hoover & Tunmer, 2022) conceptualizes reading comprehension as the product of word recognition and oral language comprehension. However, it does not specify how these skills interact. This gap is addressed by the Direct and Indirect Effects Model of Reading (DIER; Kim, 2020). This integrative model helps to understand the hierarchical, dynamic and interactive relationships between cognitive and linguistic skills, including metalinguistic competence, reading fluency linked to word reading accuracy and speed, and vocabulary (Kim, 2020, 2025). Two core competencies influence reading: firstly, accuracy and speed in word reading, supported by orthographic, phonological, and semantic knowledge; and, secondly, listening comprehension, supported by oral language skills like vocabulary and grammar.

The role of the phonological component in learning to read is well established, particularly segmental knowledge such as phonics and phonemic awareness (Melby-Lervåg et al., 2012; Yinon & Shaul, 2024). This is a necessary, but not sufficient on its own. In addition, readers must understand the systematic relationships between the phonemes in oral language and their corresponding graphemes (Frith, 1985). Along with the alphabetic principle, students should also develop an awareness of the mechanisms for mapping sounds onto letters, or vice versa, depending on the cognitive activity involved (reading or writing), referred to as *awareness of what it means to read.* Another metalinguistic competence, morphological awareness, also contributes to reading development (Giazitzidou et al., 2023). Evidence from Spanish shows that schoolchildren with higher morphological awareness read more accurately and at an appropriate speed (Rueda & Medina, 2018).

The initial development of reading skills requires two essential conditions: mastery of the alphabetic principle and awareness of what reading entails, both of which are supported by the acquisition of articulatory awareness (Novelli et al., 2024). Moreover, all these requirements must be applied accurately, quickly and with prosody (Kuhn et al., 2010) to achieve adequate reading fluency. This, in turn, is necessary for allocating cognitive resources to comprehending written text (LaBerge & Samuels, 1974).

In addition to word reading skills, the DIER (Kim, 2020) attributes a relevant role to oral language skills. The model suggests that, as reading develops, students rely more on oral language skills like grammatical knowledge and vocabulary. Vocabulary is defined as knowledge about words (Oakhill, 2020) and it ranges from shallow—knowing many words—to deep—understanding multiple meanings, relationships, and collocations (Hadley & Dickinson, 2020; Ouellette, 2006). Depth includes paradigmatic (synonyms), syntagmatic (collocations), and analytical (part-whole) knowledge (Read, 2004). Receptive vocabulary involves understanding a lexical item. Instead, expressive vocabulary involves being able to produce it in discourse. It has been shown that reading success is largely determined by the stock of words that the reader can recognise visually, so it is logical to assume that a good knowledge of vocabulary facilitates this process (Joshi, 2005).

Thus, based on the theoretical assumptions of the DIER (Kim, 2020) and other recent models, such as the Reading is Language Model (Snowling & Hulme, 2025), reading requires a range of skills. These include metalinguistic, phonemic, and morphological abilities, awareness of what reading entails, mastery of the code and fluency in reading words and pseudowords. In addition, adequate lexical, grammatical, and pragmatic knowledge is required. This idea leads us to propose the concept of reading efficiency, which results from the interaction between specific linguistic skills of reading and non-specific linguistic skills in reading (Mimeau et al., 2025). Reading efficiency is equivalent to "text reading fluency" (Kim, 2015) and it involves not only accurate and rapid word reading but also accessing word meanings and understanding their structural relationships within propositions. Thus, proficient reading requires additional skills, including listening comprehension and vocabulary, and entails at least a shallow level of comprehension (Kim, 2025).

Semantic knowledge plays an important role in the transition to efficient reading, alongside accurate and automatic knowledge of the code rules and metalinguistic awareness. Some studies have suggested that vocabulary also contributes to reading success in transparent orthographies (García-Gómez & Rueda-Sánchez, 2022); Hernández-Sobrino et al., 2023; Verhoeven et al., 2011). The impact of vocabulary knowledge on accurate and automatic reading may occur from the early stages of schooling, as the number of lexical entries for words increases, but may have a greater influence on efficiency and comprehension (Sucena et al., 2023). As students advance in school and encounter more new and infrequent oral words (Ricketts et al., 2020), reading increasingly becomes a tool for acquiring vocabulary. This relationship is suggested to strengthen over time (Killingly et al., 2024). As students read words fluently, they enhance vocabulary knowledge and word recognition by retrieving meanings during decoding (Perfetti, 2017).

Reading fluency as a tool for vocabulary acquisition

Fluent reading—with adequate accuracy and speed in reading words and pseudowords—frees cognitive resources, allowing access to new word meanings (Taylor et al., 2015). Thus, fluency becomes a tool for vocabulary acquisition. Effective decoding also helps the reader to infer unknown word meanings from context and strengthens links between word forms and meanings (Perfetti, 2017). As a result, fluency expands vocabulary breadth and depth: children connect words, understand multiple meanings, synonyms, antonyms, and infer meanings from context-rich texts (Georgiou et al., 2023). However, exposure to new vocabulary varies across oral and reading development. Early on, vocabulary comes mainly from spoken exchanges, and texts use familiar words. Later, fluent readers face texts with more specific, low-frequency vocabulary. Therefore, fluency likely supports the growth and refinement of lexical entries by enabling new associations between orthographic forms and meanings (Georgiou et al., 2023; Killingly et al., 2024; Verhoeven et al., 2011).

Vocabulary as a relevant variable in reading efficiency

The Lexical Quality Hypothesis (Perfetti, 2017) proposes that reading is enhanced when students have multimodal knowledge of words, including sounds, meanings, and letters. The greater the number of lexical entries and the more fully they are stored in memory, the more successful written word identification will be, and consequently, the more efficient reading will occur. Efficient reading requires, among other things, the synchronous activation of orthographic form, phonological/morphological form, and semantic features, perceived not as separate parts but as a whole (Perfetti, 2017). In this regard, vocabulary may influence reading efficiency by promoting redundancy in lexical representations through the consolidation of links between the three levels of word representation (Dujardin et al., 2021). That is, decoding words with known meanings reinforces the connections among orthographic, phonological/morphological, and semantic aspects, helping to form a clear representation of each word.

Furthermore, when a student reads a word, if it exists in their phonological lexicon, reading becomes easier when there is confirmation that they are reading correctly and understanding the word. Vocabulary also facilitates the recognition of new word parts, such as morphemes or orthographic patterns, which then activate known semantic and phonological representations to aid word decoding (Georgiou et al., 2023). Since efficient reading requires the integration of semantic and syntactic information at the sentence level, as well as paragraph properties and text macrostructure, vocabulary enables the interpretation of these cues, which cannot be achieved through reading skills alone. In other words, vocabulary knowledge allows for the integration of word information into the mental representation of the developing text. In the Reading Systems Framework (Perfetti & Stafura, 2014), access to word meaning is conceived as the product of an identification process. Thus, vocabulary knowledge is considered a central process, serving as a critical input for comprehension.

In summary, it appears that in languages with opaque orthographic systems, a reader with phonological, semantic, and orthographic knowledge of the word can read it more efficiently (Killingly et al., 2024; Mimeau et al., 2025).

The study extends the DIER model (Kim, 2020, 2025). It examines how proximal and distal reading components interact in dynamic and hierarchical ways. These relationships are explored in the context of Spanish, a morphophonological language with a relatively transparent alphabetic system. Specifically, we analysed the interrelations among word/pseudoword reading fluency, vocabulary knowledge, phonological and morphological awareness, and reading efficiency. At the same time, we controlled nonverbal intelligence, which may influence vocabulary and metalinguistic awareness. Within this framework, reading efficiency was proposed to be grounded in domain-general skills that support code-related knowledge (phonological, morphological, and orthographic) as well as lexical and grammatical knowledge. It is suggested that the integration of these components, together with accurate and rapid word reading, leads to greater efficiency in higher-order reading. Furthermore, from a dynamic perspective, this study focused on vocabulary and metalinguistic awareness in third-, fourth-, and fifth-grade students, based on the premise that as reading proficiency increases, oral language skills—particularly vocabulary and morphological awareness—become increasingly relevant for reading development (Kim, 2020), marking the transition from *learning to read* to *reading to learn*. In addition, Ziegler and Goswami (2005) emphasized that in transparent orthographies such as Spanish, phonological processes play a more prominent role due to high orthographic regularity. Consequently, orthographic and phonological access are more efficient, and the semantic load may be lower than in opaque languages. By integrating hierarchical and dynamic perspectives, this study aims to clarify how the interaction between code-based skills and oral language abilities contributes to reading efficiency in Spanish.

The present study

This study preliminarily examined how vocabulary, phonological and morphological awareness, reading fluency, and non-verbal intelligence may be related to reading efficiency in Spanish, using the DIER (Kim, 2020) framework as a conceptual guide. The model proposes that oral language skills, including metalinguistic awareness and vocabulary, together with word and pseudoword reading fluency, contribute to reading efficiency. In addition, fluency in word and pseudoword reading is proposed to support vocabulary development (see Fig. 1).

The main objective was to examine whether shallow and deep vocabulary explain reading efficiency in a transparent language like Spanish among 3rd to 5th graders, considering metalinguistic competence, reading fluency, and controlling for non-verbal intelligence.

The following hypotheses are proposed:

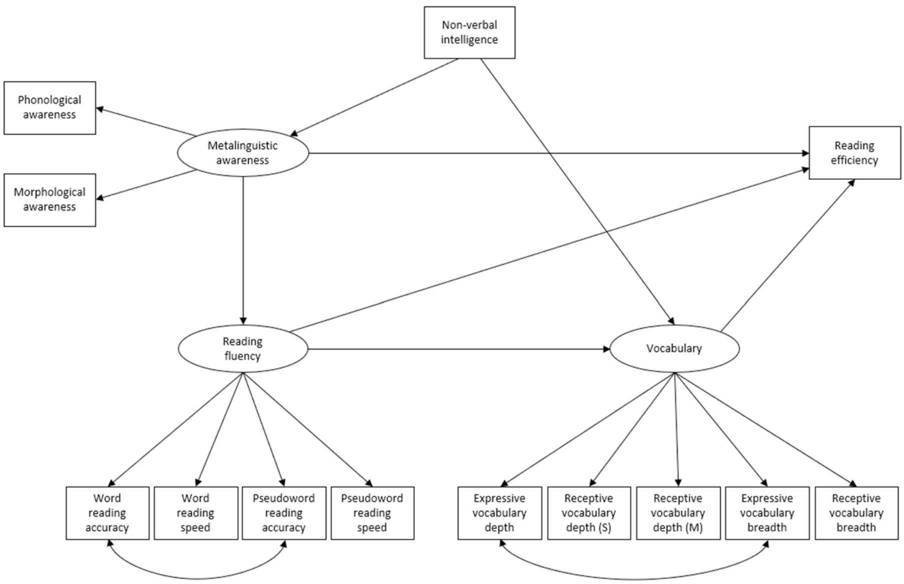

Fig. 1 Structural model of the relationships between reading efficiency, vocabulary, fluency, metalinguistic awareness and non-verbal intelligence

Hypothesis 1 *Vocabulary knowledge will be directly related to reading efficiency, as greater word knowledge supports robust lexical entries and word recognition.*

Hypothesis 2 *Vocabulary depth will contribute more than breadth to vocabulary and reading efficiency, reflecting the size and quality of lexical entries.*

Hypothesis 3 *Reading fluency will be directly related to reading efficiency, due to rapid and accurate access to orthographic and phonological forms.*

Hypothesis 4 *Reading fluency will be directly related to vocabulary knowledge.*

Hypothesis 5 *Reading fluency will be indirectly related to reading efficiency through vocabulary.*

Hypothesis 6 *Metalinguistic awareness will be directly related to reading efficiency.*

Hypothesis 7 *Metalinguistic awareness will be indirectly related to reading efficiency, mediated by reading fluency and vocabulary.*

Hypothesis 8 *Non-verbal intelligence will indirectly influence reading efficiency via metalinguistic awareness and vocabulary, with no direct effect on reading variables.*

Method

Participants

The 364 native Spanish-speaking participants (178 males, 186 females) had a mean age of 9.57 years (SD = 1.028) and were enrolled in third (n = 117), fourth (n = 113), and fifth (n = 134) grades across four schools in Salamanca. This study is part of a larger project on reading and metalinguistic awareness in reading comprehension.

Participation in the study was voluntary, and informed consent was obtained from the families prior to data collection. The study was carried out in accordance with the ethical standards of the University of Salamanca.

Procedure

Assessment took place during school hours in two sessions: a 45-min individual session for expressive vocabulary and word/pseudoword reading, and a 65-min group session for receptive vocabulary, non-verbal intelligence, phonological awareness, reading efficiency, and morphological awareness. All tests were administered in the same order for all participants and item-level responses were used for modelling rather than only total scores. Procedures followed ethical guidelines from the American Psychological Association and the Declaration of Helsinki.

Measures

Reading efficiency

The Reading Literacy Collective (TECLE; *Test Colectivo de Eficiencia Lectora*) (Marín & Carrillo, 1999) assessed word identification (phonological and lexical), as well as morphosyntactic and semantic skills to select the appropriate word while also capturing aspects of comprehension. This group-administered test took approximately 5 min and included 64 sentences, each with one missing word (e.g., *Tu balón es* [Your ball is…]) and four choices: the correct word (e.g., *rojo* [red]), two pseudowords (e.g., *rogo*), and one semantically incorrect word (e.g., *robo*). Responses were scored 1 for correct and 0 for incorrect and were randomized. In this sample, Cronbach's alpha was 0.96.

Reading fluency

Word reading accuracy Word reading accuracy was assessed by measuring the correct reading aloud of 40 words using the PROLEC-R (Cuetos et al., 2014). The Cronbach's alpha was 0.51, suggesting that the items may not consistently measure the construct. However, the subtest was retained in the analyses because it showed adequate loading on the corresponding latent variable, indicating a meaningful contribution to the construct.

Word reading speed Word reading speed was examined by determining the total reading time in seconds of 40 words from the PROLEC-R.

Pseudoword reading accuracy Pseudoword reading accuracy was assessed by counting how many of the 40 pseudowords from the PROLEC-R subtest were read aloud correctly. The Cronbach's alpha was 0.67.

Pseudoword reading speed To assess pseudoword reading speed, the time in seconds taken to read 40 pseudowords from the PROLEC-R subtest was recorded.

Vocabulary

Receptive vocabulary breadth The Peabody Picture Vocabulary Test (Dunn et al., 2006) measured receptive vocabulary using 192 items, presented in groups of 16 based on age. The child selected the picture that matched the spoken word (e.g., choosing *drum* from four images). Cronbach's alpha was 0.80.

Expressive vocabulary breadth The Expressive Vocabulary Test [name withheld] consists of 19 words from the Martínez and García (2004) Spanish Frequency Dictionary, which the participant had to define as accurately as possible. The scoring criteria for accuracy were developed based on the guidelines of the Vocabulary subtest from the Wechsler Intelligence Scale for Children–Fifth Edition (WISC-V) (Wechsler, 2014). For example, the assessor asked the participant to describe the word *orange*. One point was awarded for an imprecise definition, and two points were awarded for an accurate definition. Cronbach's alpha was 0.81.

Receptive vocabulary depth Receptive vocabulary depth was assessed using two tests. The first was the PEALE Synonym Test (Domínguez et al., 2013), which consisted of 42 items, each including a target word (e.g., *funny*) and three options (e.g., *sad*, *nervous*, *cheerful*), two of which were distractors. Participants selected the word most similar in meaning to the target (e.g., *funny–cheerful*). Cronbach's α for our sample was 0.93.

The second measure was the Meronymy Test (UADLE, 2022a), comprising 12 incomplete sentences that students completed with the holonym corresponding to each meronym (e.g., *Bone is part of… skeleton*). Responses were scored 2 points for a correct answer and 1 point for an incorrect answer. Cronbach's α was 0.72.

Expressive vocabulary depth The Multiple Meaning Test (UADLE, 2022b) includes 19 polysemic words from the Spanish Frequency Dictionary. Students scored 0–4 for each word: 0 = unknown, 1 = two imprecise meanings, 2 = two accurate, 3 => 2 meanings with ≥ 1 imprecise, 4 => 2 accurate meanings. Students identified different meanings WISC-V criteria, where an accurate response showed solid understanding (e.g., synonym, primary use, or category), while an imprecise one was correct but shallow (e.g., secondary use or vague explanation). Cronbach's alpha was 0.78.

Morphological awareness

Morphological awareness was measured with the morphological judgement subtask of the PEALE battery. The group-administered test takes 5 min and includes 64 sentences with one missing word (e.g., *The blue house is…*) and several options: the correct word (e.g., *new*), a pseudoword (e.g., *newen*), and two gender or number mismatches. Correct responses scored 1 point, with chance controlled (Score = Correct − (Incorrect – 1)). Cronbach's alpha was 0.99.

Phonemic awareness

Phonemic awareness was assessed with the Phoneme Counting task from the PEALE battery. The test has 60 pictures of everyday objects and lasts up to 3 min. Participants circled the number of phonemes in each word. Scores were based on correct counts, with randomness controlled. Cronbach's alpha was 0.99.

Non-verbal intelligence

Raven's Progressive Matrices test (Raven, 1993) was used to assess non-verbal intelligence. Participants had to choose from six options the one that completed the pattern presented. Cronbach's alpha was 0.81.

Statistical analysis

Analyses were conducted with a Structural Equation Model (SEM) using a Multiple Indicators, Multiple Causes (MIMIC) model with MPLUS 8.11 software (Muthén & Muthén, 2019). The MIMIC analysis was used to assess the relationships and direct and indirect effects between the latent variables included in the proposed model (see Fig. 1). The hypothesised model included three latent variables: vocabulary, reading fluency, and metalinguistic competence. Vocabulary was based on five indicators, three for depth (expressive/receptive) and two for breadth (expressive/receptive). Reading fluency included four indicators: word/pseudoword reading accuracy and speed. Metalinguistic awareness was based on phonological and morphological awareness.

The MIMIC model was assessed using the robust maximum likelihood (MLR) estimator, which handles non-normal data with robust errors and fit tests (Finney & Di Stefano, 2013). Given the sensitivity of the chi-square test to the sample size, the goodness-of-fit of the model was evaluated using the indices: The Comparative Fit Index (CFI), the Tucker-Lewis index (TLI) and the Root Mean Square Error of Approximation (RMSEA). More precisely, CFI and TLI values ≥ 0.90 and RMSEA values ≤ 0.08 indicate an acceptable level of model fit, while CFI and TLI values ≥ 0.95 and RMSEA values ≤ 0.06 indicate an excellent level of model fit (Hu & Bentler, 1999).

Additionally, Cohen's f^2 statistic was used to evaluate the effect size with cut-off values of low 0.02, medium 0.15, and large effect 0.35 (Cohen, 1988).

Results

Descriptive statistics and correlations

Table 1 shows the variables with mean, standard deviation, minimum, maximum, skewness (−1.872 to 1.504), and kurtosis (−1.036 to 4.302). Mardia's coefficients indicate strong multivariate non-normality: skewness = 69.410, $\chi^2 = 4{,}210.883$, $df = 455$, $p < .001$; kurtosis = 270.577, $z = 36.507$, $p < .001$.

Table 2 shows the correlation matrix of the observed variables. Morphological awareness correlated positively with reading efficiency ($r = .787$) and negatively with word reading speed ($r = -0.617$). Non-verbal intelligence is unrelated to word read-

Table 1 Descriptive statistics of the model variables

Variable	M	SD	Skew.	Kurt.	Min.	Max.
Non-verbal intelligence	48.130	25.848	0.065	−1.036	5	95
Phonemic awareness	29.459	14.239	−0.464	0.260	−8.5	60
Morphological awareness	39.647	13.385	−0.064	−0.470	3	64
Word reading accuracy	38.960	1.387	−1.872	4.302	32	40
Word reading speed	34.750	12.358	1.504	2.938	16	96
Pseudoword reading accuracy	35.470	3.407	−1.201	1.893	19	40
Pseudoword reading speed	60.810	18.251	1.151	2.502	28	160
Expressive vocabulary depth	22.077	7.539	0.397	0.336	1	51
Receptive vocabulary depth	27.229	6.968	−0.909	0.612	2.5	39
Receptive vocabulary depth	19.475	4.709	0.613	0.046	9	34
Expressive vocabulary breadth	20.418	3.929	0.848	1.750	8	36
Receptive vocabulary breadth	19.294	7.793	0.076	−1.018	0	35
Reading efficiency	32.226	11.183	0.430	−0.396	8.33	62.67

Note. *M* Mean; *SD:* Standard deviation; *Skew.:* Skewness; *Kurt.:* Kurtosis; *Min.:* Minimum value; *Max.:* Maximum value

Table 2 Correlation matrix of the variables included in the model

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Non-verbal intelligence	–												
2. Phonemic awareness	0.297**												
3. Morphological awareness	0.180**	0.532**											
4. Word reading accuracy	0.059	0.152**	0.350**										
5. Word reading speed	−0.087	−0.390**	−0.593**	−0.425**									
6. Pseudoword reading accuracy	0.157**	0.160**	0.262**	0.417**	−0.275**								
7. Pseudoword reading speed	−0.056	−0.394**	−0.553**	−0.398**	0.797**	−0.271**							
8. Expressive vocabulary depth	0.336**	0.215**	0.269**	0.170**	−0.344**	0.162**	−0.285**						
9. Receptive vocabulary depth	0.397**	0.320**	0.409**	0.176**	−0.337**	0.245**	−0.241**	0.433**					
10. Receptive vocabulary depth	0.271**	0.343**	0.449**	0.127*	−0.344**	0.136*	−0.270**	0.285**	0.409**				
11. Expressive vocabulary breadth	0.204**	0.190**	0.207**	0.106*	−0.280**	0.073	−0.241**	0.677**	0.214**	0.147**			
12. Receptive vocabulary breadth	0.275**	0.197**	0.205**	0.053	−0.224**	0.075	−0.167**	0.356**	0.307**	0.201**	0.207**		
13. Reading efficiency	0.206**	0.524**	0.787**	0.375**	−0.617**	0.307**	−0.599**	0.327**	0.429**	0.444**	0.169**	0.255**	–

Note. $p<.05$; ** $p<.01$

ing accuracy (r=0.059), word reading speed (r=−0.087) and pseudoword reading speed (r=−0.056). Correlations were observed with deep expressive (r=0.336) and receptive (r=0.397) vocabulary.

Results of the MIMIC analyses

The overall fit model was acceptable. The chi-square was significant (χ^2 = 133.59, df=58, p<.001). The values of the complementary fit indices CFI=0.956, TLI=0.941, RMSEA=0.060, 90% CI [0.047, 0.073], SRMR=0.054.

Measurement model

The MIMIC model includes three latent variables: metalinguistic competence, reading fluency, and vocabulary, each represented by multiple observed indicators (see Fig. 1; Table 3). Metalinguistic awareness is indicated by phonemic awareness (λ=0.595, p<.001) and morphological awareness (λ=0.905, p<.001). Composite reliability (omega) is 0.694 (McDonald, 1999). The latent variable reading fluency is constructed with the indicators word reading accuracy (λ=0.469, p<.001), word reading speed (λ = −0.916, p<.001), pseudoword reading accuracy (λ=0.321, p<.001), and pseudoword reading speed (λ = −0.861, p<.001). As hypothesised, the covariance between the errors of the word reading and pseudoword reading variables is significant ($\theta\varepsilon$=0.318, p<.001). This latent variable has a composite reliability ω=0.773. Finally, the measurement model of the latent variable vocabulary is constructed from five indicators: depth of expressive vocabulary (λ=0.628, p<.001), depth of receptive vocabulary synonyms (λ=0.706, p<.001), depth of receptive vocabulary meronymy (λ=0.551, p<.001), breadth of expressive vocabulary (λ=0.362, p<.001) and breadth of receptive vocabulary (λ=0.470, p<.001). The model includes covariance between errors on the expressive vocabulary depth and expressive vocabulary breadth indicators ($\theta\varepsilon$=0.622, p<.001). The composite reliability of the vocabulary construct is ω=0.693.

Structural model

Table 4 presents the results of the structural model analysis included in the MIMIC model. A significant direct effect on reading efficiency was found for the variable metalinguistic awareness (β=0.734, p<.001; f^2 = 0.485).

Metalinguistic awareness showed total effect on reading efficiency (β=0.850, p<.001, f^2 = 0.931). The indirect effects through fluency (β=0.068, p=.147) and through fluency plus vocabulary (β=0.048, p=.012) are presented in Table 4. The direct effect of metalinguistic awareness on reading fluency was significant β=0.728 (p<.001).

Vocabulary had a direct effect on reading efficiency (β=0.130, p<.001, $f^2 \approx 0$). Nonverbal intelligence had an indirect effect on reading efficiency through metalinguistic awareness (β=0.149, p<.001, f^2 = 0.004). No significant direct effect was observed between fluency and reading efficiency (β=0.094, p=.155). Fluency had an indirect effect on reading efficiency through vocabulary (β=0.066, p=.011, $f^2 \approx 0$).

Table 3 Measurement model

Latent	Observed	λ	SE	95% CI		p
				Lower	Upper	
Metalinguistic awareness	Phonemic awareness	0.595	0.038	0.532	0.658	<0.001
	Morphological awareness	0.905	0.026	0.863	0.947	<0.001
Reading fluency	Word reading accuracy	0.469	0.053	0.382	0.557	<0.001
	Word reading speed	−0.916	0.024	−0.955	−0.877	<0.001
	Pseudoword reading accuracy	0.321	0.056	0.228	0.414	<0.001
	Pseudoword reading speed	−0.861	0.024	−0.901	−0.822	<0.001
Vocabulary	Expressive vocabulary depth	0.628	0.044	0.555	0.700	<0.001
	Receptive vocabulary depth	0.706	0.041	0.638	0.774	<0.001
	Receptive vocabulary depth	0.551	0.047	0.474	0.628	<0.001
	Expressive vocabulary breadth	0.362	0.061	0.261	0.463	<0.001
	Receptive vocabulary breadth	0.470	0.051	0.387	0.554	<0.001

Note. *λ:* Standardised estimate; *SE:* Standard Error; *CI:* Confidence Intervals

The null effect sizes could be explained by multicollinearity or a statistical suppression effect. No evidence of multicollinearity was detected. Variance Inflation Factor (VIF) values ranged from 1.56 to 2.91. The suppression effect does not appear to be plausible, as the correlations between latent variables and each of them with reading efficiency were positive (r=0.526, 0.863) and the intercorrelations among latent variables were moderate (r=0.466, 0.728). Likewise, no artificial increases in the β coefficients were observed, and their signs were maintained (e.g., for vocabulary, r=0.526 → β=0.130).

Figure 2 illustrates the main associations among the variables. The MIMIC model explained 76.7% of the variance in reading efficiency (R^2 = 0.767, f^2 = 3.29).

Based on these results, an additional model was tested excluding metalinguistic awareness to evaluate the direct and indirect effects of reading fluency and vocabulary on reading efficiency.

Figure 3 shows the additional MIMIC model. The model yielded the following results: χ^2 (40)=70.009, p=.002, CFI=0.975, TLI=0.966, RMSEA=0.045, 90% CI [0.027, 0.063], SRMR=0.048, R^2 = 0.550, and f^2 = 0.694. When metalinguistic awareness was excluded from the model, fluency had a direct effect on reading efficiency (β=0.508, p<.001, f^2 = 1.12) and an indirect effect through vocabulary (β=0.171, p<.001, f^2 = 0.456), resulting in a total effect of β=0.679, p<.001. The direct relationship between vocabulary and reading efficiency was β=0.344, p<.001, f^2 = 0.136. Nonverbal intelligence predicted vocabulary (β=0.512, p<.001).

Finally, the potential influence of grade and age on the proposed model of reading efficiency was examined. Preliminary analyses revealed a correlation (r=0.854, p<.001) and collinearity (VIF=3.684). Consequently, the decision was made to include only the variable grade in the MIMIC model, as it is more closely associated with cumulative formal instruction and reading practice. This variable was incorporated as a covariate of both the latent variables and the dependent variable.

The model showed acceptable fit, χ^2 = 170.843, df=67, p<.001, CFI=0.945, TLI=0.926, RMSEA=0.065, 90% CI [0.053, 0.077], SRMR=0.050. No significant direct effects on reading efficiency were detected (β = −0.048, p=.268, 95% CI [−0.134, 0.037]). Significant indirect effects were observed through metalinguis-

Table 4 Structural model

Predictor	Dependent	β	SE	95% CI Lower	95% CI Upper	*p*
Direct effects						
Non-verbal intelligence	Metalinguistic awareness	0.203	0.054	0.114	0.293	<0.001
Non-verbal intelligence	Vocabulary	0.485	0.045	0.412	0.559	<0.001
Metalinguistic awareness	Reading fluency	0.728	0.035	0.670	0.785	<0.001
Metalinguistic awareness	Reading efficiency	0.734	0.069	0.620	0.847	<0.001
Reading fluency	Vocabulary	0.505	0.053	0.417	0.592	<0.001
Reading fluency	Reading efficiency	0.094	0.066	−0.015	0.203	0.155
Vocabulary	Reading efficiency	0.130	0.050	0.047	0.213	0.010
Indirect effects						
(1) Non-verbal intelligence	Reading efficiency	0.149	0.042	0.080	0.219	<0.001
(2) Non-verbal intelligence	Reading efficiency	0.063	0.024	0.023	0.103	0.010
(3) Non-verbal intelligence	Reading efficiency	0.014	0.010	−0.003	0.031	0.179
(4) Non-verbal intelligence	Reading efficiency	0.010	0.004	0.003	0.017	0.027
(5) Metalinguistic awareness	Reading efficiency	0.068	0.047	−0.009	0.146	0.147
(6) Metalinguistic awareness	Reading efficiency	0.048	0.019	0.017	0.079	0.012
(7) Reading fluency	Reading efficiency	0.066	0.026	0.023	0.108	0.011
Total indirect effects						
Non-verbal intelligence	Reading efficiency	0.236	0.049	0.155	0.317	<0.001
Metalinguistic awareness	Reading efficiency	0.116	0.047	0.038	0.194	0.014

CI Confidence Intervals, *β* Standardised estimate, *SE*: Standard Error

(1): Non-verbal intelligence → Metalinguistic awareness → Reading efficiency

(2): Non-verbal intelligence → Vocabulary → Reading efficiency

(3): Non-verbal intelligence → Metalinguistic awareness → Reading fluency → Reading efficiency

(4): Non-verbal intelligence → Metalinguistic awareness → Reading fluency → Vocabulary → Reading efficiency

(5): Metalinguistic awareness → Reading fluency → Reading efficiency

(6): Metalinguistic awareness → Reading fluency → Vocabulary → Reading efficiency

(7): Reading fluency → Vocabulary → Reading efficiency

tic awareness (β=0.352, p<.001, 95% CI [0.248, 0.455]), and through vocabulary (β=0.050, p<.046, 95% CI [0.001, 0.010]).

Discussion

The study explored the potential impact of vocabulary knowledge on reading efficiency and the possible role of reading fluency in vocabulary development. Consistent with the DIER (Kim, 2020), the results suggest that reading fluency, metalinguistic competence, and vocabulary may all contribute to reading efficiency, although their relative contributions could vary. Key effects are discussed below.

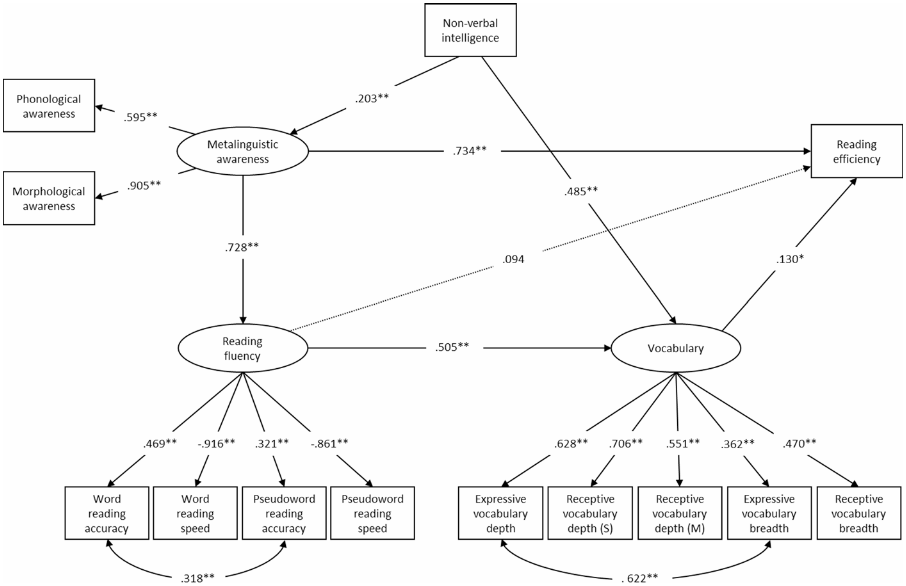

Fig. 2 Final respecified model (MIMIC). Note: *$p<.05$; ** $p<.01$.

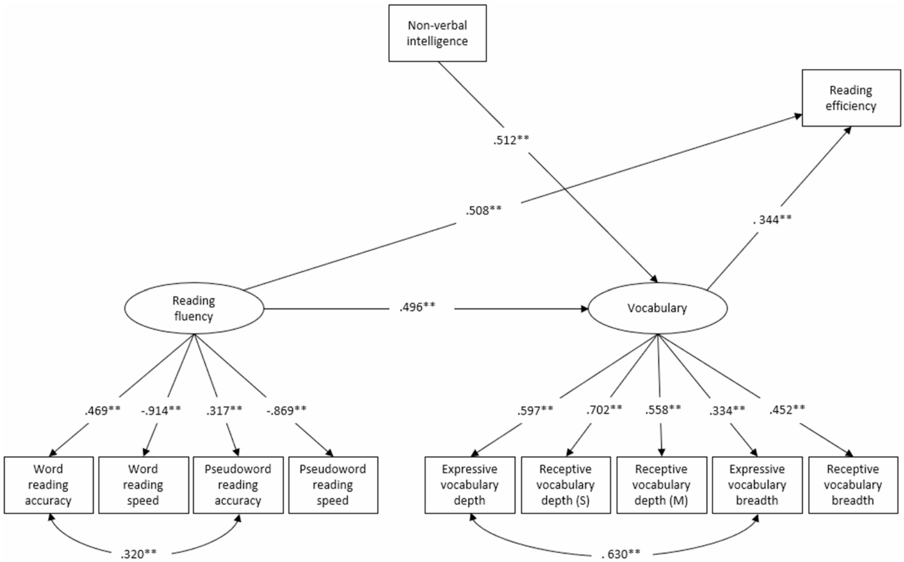

Fig. 3 Final respecified model (MIMIC). Note: ** $p<.01$

Direct effect of vocabulary breadth and depth on reading efficiency

This study observed a positive association between vocabulary and reading efficiency (Hypothesis 1), in line with findings reported in other languages (Duff et al., 2015; Oakhill, 2020; Ouellette, 2006). It is also aligned with the DIER (Kim, 2020), which links oral language skills to reading accuracy and speed, forming the basis of reading fluency, here termed *reading efficiency*. This finding suggests that vocabulary may support reading efficiency by linking phonological, orthographic, and semantic representations, enhancing sensitivity to sub-lexical details, and aiding in correcting decoding errors. Reading efficiency may result from representations that are stable and accessible for automatic word retrieval (Perfetti, 2017). Therefore, the more knowledge networks are built around a word, the easier and faster it can be retrieved. Consequently, vocabulary can act as a facilitating factor that supports the acquisition of more accurate and redundant word representations, leading to more efficient reading. Furthermore, vocabulary may provide a mechanism for understanding sentence meaning at a structural level, through the semantic and syntactic relationships of the words that make up sentences.

One of the notable findings of this research was identifying the potential contribution of both the depth and breadth of vocabulary in its expressive and receptive dimensions. Among the different vocabulary indicators, the expressive and receptive vocabulary depth variables contribute the most to the latent variable vocabulary and, therefore, to reading efficiency (Hypothesis 2). In other words, indicators of deep knowledge appear to contribute more, suggesting that knowing a word's phonological label alone may not be sufficient, and that richer, more elaborated knowledge could play an important role. According to the lexical restructuring hypothesis (Metsala & Walley, 1998), shallow knowledge of words, based mainly on phonological or syntactic information, may play a role in supporting reading accuracy and the set for variability (Venezky, 1999). However, if reading efficiency depends on the automatic retrieval and storage of orthographic representations, a richer and more complete semantic representation may facilitate this process more than vocabulary breadth (Oakhill, 2020). This is because vocabulary depth provides greater information about the quality of linguistic word representations (Hadley & Dickinson, 2020). One explanation for this finding may be that vocabulary depth reflects how words are organised in the mental lexicon. This links the three levels of word representation and facilitating rapid access from one to another, which helps the reader to recognise and decode words more quickly and easily (Dujardin et al., 2021). That is, more elaborate and interconnected semantic representations may be more conducive to efficient reading than a shallow or broad vocabulary (Oakhill, 2020) because more resources are available to access the word. Therefore, in line with the Lexical Quality Hypothesis (Perfetti, 2017), these results may reflect the role of integrated and interrelated representations in efficient reading.

Further analysis suggests that, among the three indicators of deep vocabulary, synonymy appears to contribute more to the latent vocabulary variable and reading efficiency, followed by polysemy and meronymy. Synonymy and polysemy reflect paradigmatic relationships, linking words by shared qualities, while meronymy represents part-whole (analytical) relations, where one word (meronym) is part of another (holonym). This finding is consistent with previous research on transparent alphabetic orthographies, such as that of García-Gómez & Rueda-Sánchez (2022) or that of Hernández-Sobrino et al. (2023). In samples of students in the third year of preschool and the first and second years of primary school, respectively, these studies found that deep vocabulary has greater power than shallow vocabulary in explaining initial reading. In the present study, we extend these findings by examining the relationship between vocabulary and reading efficiency in higher-grade students and adding analytical relationships.

Finally, no difference was found between the contributions of expressive and receptive vocabulary. However, one could argue that the ability to use a word expressively suggests a stronger lexical representation, increasing its likelihood of activation during reading. On the other hand, the results are consistent if we consider that reading is primarily a receptive skill, since the main task is to recognise and retrieve grapheme-phoneme correspondences (Moon & Kim, 2024). In addition, students often show a receptive understanding of a word without being able to produce expressive knowledge (Schmitt, 2019). Therefore, a deep understanding of the form and meaning of words seems to be sufficient.

Direct effects of reading fluency on vocabulary and indirect effects of reading efficiency

The results suggested a direct association between reading fluency and vocabulary knowledge, such that higher reading fluency was associated with higher vocabulary levels (Hypothesis 4). This finding is consistent with that of Georgiou et al. (2023), who found that decoding ease predicted later levels of vocabulary knowledge in a sample of 172 Canadian schoolchildren. Similarly, Dulay et al. (2021) followed a sample of Chinese schoolchildren from preschool to the end of first grade and found that early word reading predicted future vocabulary. Furthermore, the results suggest a possible indirect association between reading fluency and reading efficiency, potentially mediated by vocabulary knowledge (Hypothesis 5). That is, as students develop decoding expertise, they may be more likely to encounter and learn new vocabulary from texts (Georgiou et al., 2023), which could in turn support more efficient reading (Duff et al., 2015). This finding has also been reported in studies such as that of Verhoeven et al. (2011), who found that among Dutch students, vocabulary in grade 1 predicted reading in grade 2, and word reading in grades 2 and 3 predicted vocabulary knowledge in grades 3 and 5. In a longitudinal study of Australian schoolchildren in grades 1–5, Killingly et al. (2024) found bidirectional relationships between vocabulary and word recognition. Students' ability to read words fluently helps them to acquire new associations between orthographic forms and their meanings and, at the same time, this knowledge improves the identifiability of the word by providing a stronger basis for visual recognition of words during reading. One potential interpretation is that vocabulary knowledge could both contribute to reading efficiency and be influenced by reading fluency, although this remains to be tested in future research. To our knowledge, no study has examined the relationship between vocabulary and reading (and vice versa) in Spanish with a solid theoretical foundation that considers the multiple dimensions of what it means to know a word.

It is possible that in the early stages of learning to read, when phonological decoding is essential, the importance of vocabulary is attributed to its positive relationship with phonological awareness (Ouellette & Haley, 2013). Accordingly, studies with English language learners suggest that the facilitating role of vocabulary appears to diminish as students become more advanced readers (Moon & Kim, 2024). This study raises the possibility that, in Spanish, at more advanced grades where phonological decoding is less relied upon, vocabulary knowledge contributes to phonological skills and the formation of a stable, accessible word knowledge network that supports efficient reading, in line with the Lexical Quality Hypothesis (Perfetti, 2017).

Assuming a possible link between reading ability and vocabulary knowledge, stronger readers may be more likely to encounter and learn new words than struggling readers, potentially influencing both the breadth and depth of their vocabulary—an idea broadly consistent with the Matthew effect (Stanovich, 1986). Reading experience could act as an important mediating factor between reading ability and vocabulary, with cumulative benefits that might not be experienced by students who face reading difficulties. These considerations highlight the potential importance of supporting students in developing reading proficiency as early as possible.

Direct and indirect effects of metalinguistic awareness and reading fluency on reading efficiency

This study suggests that metalinguistic awareness may have a direct association with reading efficiency (Hypothesis 6) and a possible indirect association through reading accuracy, reading speed, and vocabulary knowledge (Hypothesis 7). In this sample of students, it appeared to be the variable with the strongest explanatory contribution. As students become more aware of the minimal components of words, they may be able to read them with greater speed and accuracy, which contributes to the generation of stable and redundant orthographic, phonological and semantic representations and enables more efficient reading. This finding is consistent with several studies that have highlighted the role of phonological (Melby-Lervåg et al., 2012) and morphological awareness (Rueda & Medina, 2018) in reading. There is strong evidence that the ability to segment words into their minimal elements and to identify correspondences between speech sounds and written letters is fundamental to learning to read. Moreover, morphological awareness promotes reading fluency and vocabulary by facilitating the analysis of small units of meaning and the association of unfamiliar words with those already stored in the lexicon (Giazitzidou et al., 2023; Kirby et al., 2025). That is, morphological knowledge provides information about the pronunciation of words, their spelling, their meaning and the grammatical function they perform (Ardanouy & Deacon, 2024). Therefore, the results suggest that metalinguistic awareness may be associated with reading efficiency, both directly and potentially indirectly through reading fluency and vocabulary knowledge (Hypothesis 7).

Interestingly, the effect of morphological awareness, as an indicator of metalinguistic knowledge, on efficiency is greater than that of phonological awareness. This suggests that, once reading automaticity is attained, other linguistic variables associated with global and automatic word retrieval become increasingly influential. In particular, morphological awareness and vocabulary knowledge may contribute more to the development of efficient reading. This evidence points to the possibility that morphological awareness may have a relatively greater role than phonological awareness in readers with higher proficiency (Kim, 2020). Although this notion aligns with the hypothesis that efficient reading involves some degree of surface-level comprehension (Kim, 2025), it partially contrasts with the central theory put forward by Ziegler and Goswami (2005). This theory argues that, in transparent orthographies, readers primarily rely on small sublexical units and phonological processing rather than on larger linguistic units. Perhaps it is the morphological complexity, richness and transparency of the writing system that may or may not promote sensitivity to the morphological structure of written words and its role in reading (Bar-On & Ravid, 2011). Similarly, Yinon and Shaul (2024) found that in Hebrew learners, morphology contributed more than phonology as early as second grade. It can therefore be concluded that in the process of reading development, the role of phonological awareness does not disappear, but is influenced by a level of skill that complements it and enables more efficient reading.

Moreover, it is worth noting the existence of a mediation effect among metalinguistic competence, reading fluency, and reading efficiency. In the absence of metalinguistic competence, reading fluency accounts for a large proportion of the explained variance. Both variables share a common cognitive basis related to the automatization of linguistic processes. However, when metalinguistic awareness is incorporated into the model, the direct effect of fluency decreases. Consequently, this indicates that an important part of its influence on reading efficiency stems from underlying metalinguistic abilities. This pattern supports the idea that metalinguistic skills contribute to efficient reading not only directly, but also indirectly by enhancing reading fluency (Kim, 2015).

Additionally, when metalinguistic awareness is incorporated into the model, its indirect effects through reading fluency and vocabulary reduce the direct influence of vocabulary on reading efficiency. This suggests that vocabulary partly reflects the impact of metalinguistic processes that enhance both fluency and lexical development (Kim, 2015; Perfetti & Stafura, 2014). When metalinguistic awareness is excluded, the weight of vocabulary increases, capturing variance that originates from these skills, consistent with the idea that vocabulary acts as a late mediator in efficient reading (Cain et al., 2004).

Although not the primary focus, non-verbal intelligence was included as a covariate and was found to influence reading efficiency indirectly, mainly through metalinguistic awareness and vocabulary knowledge (Hypothesis 8).

Finally, it was examined the predictive role of school grade, which is highly correlated with age. The results indicate that reading efficiency is more closely associated with linguistic skills than with grade level. Specifically, the effects of grade are largely mediated by metalinguistic awareness, which is strongly influenced by morphological awareness. Morphological awareness, in turn, develops with schooling (Kuo & Anderson, 2006).

Overall, the results should be viewed within an ecological framework, as socioeconomic and contextual factors (e.g., parental education and home literacy quality) can shape the links among vocabulary, morphological awareness, reading fluency, and efficiency (Aaron et al., 2008; Zhang et al., 2025).

Implications

The findings of this study indicate that phonemic and morphological awareness, code knowledge, and automatization are essential for reading. In addition to these skills, efficient reading may also benefit from oral language abilities, such as deep vocabulary knowledge. This study provides tentative evidence that an integrated approach might enhance reading efficiency. This can be achieved by combining attention to the sound and morphological structure of words and code knowledge, together with instruction in word meanings. The findings highlight the importance of deep vocabulary instruction, including contextual word use, teaching antonyms and synonyms, structural analysis, and morphemic roots to support meaning (Joshi, 2005).

Limitations and future directions

This study has several limitations. First, as a cross-sectional study, causal directions among the variables studied cannot be confirmed. Future research should include broader language and cognitive variables, such as listening comprehension, suprasegmental awareness or working memory, to provide a more comprehensive understanding of reading efficiency.

Second, the word reading accuracy subtest showed relatively low internal consistency, indicating that its items may not consistently measure the construct and could attenuate related effects in the model. However, its adequate loading on the latent variable suggests a meaningful contribution to the construct. This limitation should be considered when interpreting the results, and future research should refine the subtest or increase the number of items to enhance reliability.

Third, vocabulary measures in this study were largely decontextualized, assessing knowledge of individual words rather than their use in meaningful contexts, which may reduce the ecological validity of the findings. Additionally, some words may vary in frequency or cultural relevance within the Spanish language, potentially influencing reading efficiency. Although expressive and receptive shallow and deep vocabulary were assessed, other facets such as vocabulary fluency remain to be examined.

Fourth, reading efficiency was measured using a single instrument, which may limit the robustness of the findings. Future studies could benefit from employing multiple measures to capture this construct more comprehensively and reliably.

Fifth, the structural equation model only tested one-way relationships, while reciprocal effects could provide deeper insight. It is also important to note that SEM and MIMIC results depend on the model specification. Alternative models might yield different parameter estimates. Factors such as attention, prior knowledge, and motivation, which also influence reading efficiency, were not considered, limiting the model's explanatory power.

Additionally, the findings are based on native Spanish-speaking students, so generalizability may be limited. L2 learners or speakers of different Spanish dialects might show different reading fluency and efficiency patterns due to linguistic, cultural, or educational factors.

Finally, the mediation effects observed among the variables should be interpreted as theory-consistent rather than as evidence of causal relationships. Consequently, these provisional results highlight the need for longitudinal and intervention studies, ideally beginning in the preschool years, to more precisely explore the direction, nature, and potential causal mechanisms underlying the role of vocabulary in reading efficiency.

Conclusion

Based on the DIER model (Kim, 2020), this study found that metalinguistic competence—both phonemic and morphological—, reading fluency, and vocabulary knowledge, particularly in its depth dimension, significantly contribute to reading efficiency in this sample of Spanish schoolchildren. In this regard, and with due caution, we propose as a plausible hypothesis that metalinguistic competence, together with reading fluency, may be necessary but not entirely sufficient to achieve reading efficiency. This distinction between fluency and efficiency is suggested based on the patterns observed in our sample of Spanish schoolchildren but cannot be conclusively confirmed with the current data. Recognizing this separation has considerable pedagogical relevance, as it helps guide assessment and educational interventions: it may be advisable to strengthen decoding automation to enhance fluency and to develop semantic, morphosyntactic, and strategic skills to optimize reading efficiency. Finally, this study makes a novel contribution to the field by examining the relationship between vocabulary and reading—an area that has been little explored in the case of Spanish—using latent variables and considering the influence of other variables on reading efficiency.

Acknowledgements This study has been carried out within the framework of the collaboration agreement (Art. 83) existing between the University of Salamanca and the Diputación de Salamanca (Salamanca provincial government). We would like to express our gratitude to María Asensio-Asensio for her participation in the data collection for this research.

Author contributions The first author was responsible for the research conceptualization and design, data-collection, and manuscript writing and interpretation. The second author supervised the project and data collection, performed the statistical analyses, interpreted the results, and revised the manuscript. The third author was responsible, along with the first author, for the project conceptualization and design, the writing process, supervision of data analyses, and interpretation of the results. All authors contributed to the writing of the manuscript, revised it, and approved the final version.

Funding Open access funding provided by FEDER European Funds and the Junta de Castilla y León under the Research and Innovation Strategy for Smart Specialization (RIS3) of Castilla y León 2021-2027.

Data availability No datasets were generated or analysed during the current study.

Declarations

Competing interests The authors declare no competing interests.

References

Aaron, P. G., Joshi, R. M., Gooden, R., & Bentum, K. E. (2008). Diagnosis and treatment of reading disabilities based on the component model of reading: An alternative to the discrepancy model of LD. *Journal of Learning Disabilities*, *41*(1), 67–84. https://doi.org/10.1177/0022219407310838

Ardanouy, E., & Deacon, S. H. (2024). Morphological awareness and reading comprehension: To what extent do semantic relations in the classic sentence completion task influence associations? *Reading and Writing*, *38*, 2563–2579. https://doi.org/10.1007/s11145-024-10606-8

Bar-On, A., & Ravid, D. (2011). Morphological analysis in learning to read pseudowords in Hebrew. *Applied Psycholinguistics*, *32*(3), 553–581. https://doi.org/10.1017/S014271641100021X

Cain, K., Oakhill, J., & Lemmon, K. (2004). Individual differences in the inference of word meanings from context: The influence of reading comprehension, vocabulary knowledge, and memory capacity. *Journal of Educational Psychology*, *96*(4), 671. https://doi.org/10.1037/0022-0663.96.4.671

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Lawrence Erlbaum Associates.

Cuetos, F., Rodríguez, B., Ruano, E., & Arribas, D. (2014). *PROLEC-R: Batería de evaluación de los procesos lectores (5.ª ed.).* TEA Ediciones.

Domínguez, A. B., Alegría, J., Carrillo, M., & Soriano, J. (2013). *Pruebas de Evaluación Analítica de Lengua Escrita*. Universidad de Salamanca.

Duff, F. J., Reen, G., Plunkett, K., & Nation, K. (2015). Do infant vocabulary skills predict school-age language and literacy outcomes? *Journal of Child Psychology and Psychiatry*, *56*(8), 848–856. https://doi.org/10.1111/jcpp.12378

Dujardin, E., Auphan, P., Bailloud, N., Ecalle, J., & Magnan, A. (2021). Tools and teaching strategies for vocabulary assessment and instruction: A review. *Social Education Research*, *3*(1), 34–66. https://doi.org/10.37256/ser.3120221044

Dunn, L. M., & Dunn, L. M. (2006). *Test de vocabulario en imágenes Peabody (*D. Arribas, Adapt.) TEA Ediciones.

Finney, S. J., & DiStefano, C. (2013). Non-normal and categorical data in structural equation modeling. In G. R. Hancock & R. O. Mueller (Eds.), *Structural equation modeling: A second course* (pp. 439–492). IAP.

Frith, U. (1985). Beneath the surface of developmental dyslexia. In K. Patterson, J. Marshall, & M. Coltheart (Eds.), *Surface dyslexia: Neurological and cognitive studies of phonological reading* (pp. 301–330). Lawrence Erlbaum.

García-Gómez, L., & Rueda-Sánchez, M. I. (2022). Vocabulary depth as preliteracy skill. R*evista de Investigación en Logopedia, 12*(2), e79647. https://doi.org/10.5209/rlog.79647

Georgiou, G., Inoue, T., & Parrila, R. (2023). Are vocabulary and word reading reciprocally related? *Scientific Studies of Reading*, *27*(2), 160–168. https://doi.org/10.1080/10888438.2022.2123275

Giazitzidou, S., Grigorakis, I., Mouzaki, A., & Padeliadu, S. (2023). Exploring the relations of morphological awareness with phonological awareness and vocabulary: The case of the Greek Language. *Journal of Psycholinguistic Research*, *52*(6), 2621–2644. https://doi.org/10.1007/s10936-023-10006-z

Hadley, E. B., & Dickinson, D. K. (2020). Measuring young children's word knowledge: A conceptual review. *Journal of Early Childhood Literacy*, *20*(2), 223–251. https://doi.org/10.1177/1468798417753713

Hernández-Sobrino, L., García-Navarro, M., González, V., & Domínguez, A. B. (2023). ¿Es el vocabulario profundo una habilidad necesaria para la comprensión lectora en los primeros cursos de Educación Primaria? *Revista de Psicología y Educación*, *18*(1), 11–21. https://doi.org/10.23923/rpye2023.01.230

Hoover, W. A., & Tunmer, W. E. (2022). The primacy of science in communicating advances in the science of reading. *Reading Research Quarterly*, *57*(2), 399–408. https://doi.org/10.1002/rrq.446

Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal*, *6*(1), 1–55. https://doi.org/10.1080/10705519909540118

Joshi, R. M. (2005). Vocabulary: A critical component of comprehension. *Reading and Writing Quarterly: Overcoming Learning Difficulties*, *21*(3), 209–219. https://doi.org/10.1080/10573560590949278

Killingly, C., Graham, L. J., Tancredi, H., & Snow, P. (2024). Reciprocal relationships among reading and vocabulary over time: A longitudinal study from grade 1 to 5. *Reading and Writing*, *38*, 1–21. https://doi.org/10.1007/s11145-024-10522-x

Kim, Y. S. G. (2015). Developmental, component-based model of reading fluency: An investigation of word-reading fluency, text-reading fluency, and reading comprehension. *Reading Research Quarterly*, *50*, 459–481. https://doi.org/10.1002/rrq.107

Kim, Y. S. G. (2020). Toward integrative reading science: The direct and indirect effects model of reading. *Journal of Learning Disabilities*, *53*(6), 469–491. https://doi.org/10.1177/0022219420908239

Kim, Y. S. G. (2025). Learning to read in Korean: An application of the Direct and Indirect Effect Model of Reading (DIER). In H. K. Pae, H. Winskel, & S. Y. Kim (Eds.), *Handbook on the Korean language and literacy: Insights into Hangul and text processing* (pp. 373–387). Springer. https://doi.org/10.1007/978-3-031-88087-2_18

Kirby, J. R., Deacon, S. H., Georgiou, G., Geier, K., Chan, J., & Parrila, R. (2025). Effects of morphological awareness, naming speed, and phonological awareness on reading skills from grade 3 to grade 5. *Journal of Experimental Child Psychology*, *253*, 106188. https://doi.org/10.1016/j.jecp.2024.106188

Kuhn, M. R., Schwanenflugel, P. J., & Meisinger, E. B. (2010). Aligning theory and assessment of reading fluency: Automaticity, prosody, and definitions of fluency. *Reading Research Quarterly*, *45*(2), 230–251. https://doi.org/10.1598/RRQ.45.2.4

Kuo, L. J., & Anderson, R. C. (2006). Morphological awareness and learning to read: A cross-language perspective. *Educational Psychologist*, *41*(3), 161–180. https://doi.org/10.1207/s15326985ep4103_3

LaBerge, D., & Samuels, S. J. (1974). Toward a theory of automatic information processing in reading. *Cognitive Psychology*, *6*(2), 293–323. https://doi.org/10.1016/0010-0285(74)90015-2

Marín, J., & Carrillo, M. S. (1999). *Test colectivo de eficiencia lectora (TECLE)*. Universidad de Murcia.

McDonald, R. P. (1999). *Test theory: A unified treatment*. Lawrence Erlbaum Associates.

Melby-Lervåg, M., Lyster, S. A., & Hulme, C. (2012). Phonological skills and their role in learning to read: A meta-analytic review. *Psychological Bulletin*, *138*(2), 322–352. https://doi.org/10.1037/a0026744

Metsala, J. L., & Walley, A. C. (1998). Spoken vocabulary growth and the segmental restructuring of lexical representations: Precursors to phonemic awareness and early reading ability. In J. L. Metsala, & L. C. Ehri (Eds.), *Word recognition in beginning literacy* (pp. 89–120). Erlbaum.

Mimeau, C., Ricketts, J., & Deacon, S. H. (2025). Learning spellings and meanings: Longitudinal relations to reading. *Journal of Research in Reading*, *48*(1), 1–17. https://doi.org/10.1111/1467-9817.12477

Moon, Y., & Kim, Y. S. G. (2024). Do the relations of vocabulary and attentional control with word reading and spelling change as a function of development and spelling scoring method? *Journal of Experimental Child Psychology*, *246*, 106019. https://doi.org/10.1016/j.jecp.2024.106019

Muthén, L., & Muthén, B. (1998–2019). *Mplus users guide*. Muthén & Muthén.

Novelli, C., Ardoin, S. P., & Rodgers, D. B. (2024). Seeing the mouth: The importance of articulatory gestures during phonics training. *Reading and Writing*, *37*, 2521–2547. https://doi.org/10.1007/s11145-023-10487-3

Oakhill, J. (2020). Four decades of research into children's reading comprehension: A personal review. *Discourse Processes*, *57*(5–6), 402–419. https://doi.org/10.1080/0163853X.2020.1740875

Ouellette, G. P. (2006). What's meaning got to do with it: The role of vocabulary in word reading and reading comprehension. *Journal of Educational Psychology*, *98*(3), 554–566. https://doi.org/10.1037/0022-0663.98.3.554

Ouellette, G. P., & Haley, A. (2013). One complicated extended family: The influence of alphabetic knowledge and vocabulary on phonemic awareness. *Journal of Research in Reading*, *36*(1), 29–41. https://doi.org/10.1111/j.1467-9817.2010.01486.x

Perfetti, C. A. (2017). Lexical quality revisited. In E. Segers, & van den P. Broek (Eds.), *Developmental perspectives in written language and literacy: In honor of Ludo verhoeven* (pp. 51–67). John Benjamins.

Perfetti, C., & Stafura, J. (2014). Word knowledge in a theory of reading comprehension. *Scientific Studies of Reading*, *18*(1), 22–37. https://doi.org/10.1080/10888438.2013.827687

UADLE. (2022a). *Prueba de significados múltiples* [Instrumento no publicado]. Universidad de Salamanca.
UADLE. (2022b). *Prueba de vocabulario expresivo* [Instrumento no publicado]. Universidad de Salamanca.
Raven, J. (1993). *Test de Matrices Progresivas: Escala general.* Paidós.
Read, J. (2004). Plumbing the depths: How should the construct of vocabulary knowledge be defined? In P. Bogaards, & B. Laufer (Eds.), *Vocabulary in a second language: Selection, acquisition and testing* (pp. 209–227). John Benjamins.
Ricketts, J., Lervåg, A., Dawson, N., Taylor, L. A., & Hulme, C. (2020). Reading and oral vocabulary development in early adolescence. *Scientific Studies of Reading*, *24*(5), 380–396. https://doi.org/10.1080/10888438.2019.1689244
Rueda, M. I., & Medina, S. L. (2018). The role of morphological awareness in explaining reading-writing difficulties. *Journal for the Study of Education and Development: Infancia y Aprendizaje, 41*(4), 702–732. https://doi.org/10.1080/02103702.2018.1504861
Sánchez, E. (2024). *Humanos y civilizados: examinando el reto que supone alfabetizar a toda la población*. Universidad de Salamanca.
Schmitt, N. (2019). Understanding vocabulary acquisition, instruction, and assessment: A research agenda. *Language Teaching*, *52*(2), 261–274. https://doi.org/10.1017/S0261444818000344
Snowling, M. J., & Hulme, C. (2025). The reading is language model: A theoretical framework for language and reading development and intervention. *Annual Review of Developmental Psychology*, *7*, 1–25. https://doi.org/10.1146/annurev-devpsych-111323-084821
Stanovich, K. E. (1986). Matthew effects in reading: Some consequences of individual differences in the acquisition of literacy. *Reading Research Quarterly*, *21*(1–2), 360–406. https://doi.org/10.1598/RRQ.21.4.1
Sucena, A., Garrido, C., Marques, C., & Lousada, M. (2023). Early predictors of reading success in first grade. *Frontiers in Psychology*, *14*, 1140823. https://doi.org/10.3389/fpsyg.2023.1140823
Taylor, J. S. H., Duff, F. J., Woollams, A. M., Monaghan, P., & Ricketts, J. (2015). How word meaning influences word reading. *Current Directions in Psychological Science*, *24*(4), 322–328. https://doi.org/10.1177/0963721415574980
Venezky, R. L. (1999). *The American way of spelling: The structure and origins of American English orthography*. Guilford Press.
Verhoeven, L., Van Leeuwe, J., & Vermeer, A. (2011). Vocabulary growth and reading development across the elementary school years. *Scientific Studies of Reading*, *15*(1), 8–25. https://doi.org/10.1080/10888438.2011.536125
Wechsler, D. (2014). *Wechsler intelligence scale for Children–Fifth edition (WISC-V)*. Pearson.
Yinon, R., & Shaul, S. (2024). Examining the developmental trade-off between phonology and morphology in Hebrew reading acquisition. *Reading and Writing*, *38*, 1435–1459. https://doi.org/10.1007/s11145-024-10570-3
Zhang, X., Wang, M., Shu, H., & Xia, Z. (2025). Brain structural connectivity and morphological awareness mediate the association between home literacy environment and reading outcomes in children with family history of reading difficulties. *Developmental Science*, *28*(5), e70056. https://doi.org/10.1111/desc.70056
Ziegler, J. C., & Goswami, U. (2005). Reading acquisition, developmental dyslexia, and skilled reading across languages: A psycholinguistic grain size theory. *Psychological Bulletin*, *131*(1), 3–29. https://doi.org/10.1037/0033-2909.131.1.3

Publisher's note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.