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Vocabulary depth as preliteracy skill

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Abstract. The aim of this study is to explore the predictive value of vocabulary breadth and depth together with the classical variables of phonological awareness, naming speed and alphabetic knowledge, in explaining progress in the initial learning of reading and writing in a sample of 162 schoolchildren in the third year of early childhood education. Early detection of risks in learning to read is essential to be able to intervene proactively if signs of dyslexia are found. The study of skills that predict successful literacy acquisition may be useful to identify risk indicators of learning disabilities in reading and writing in early childhood education. The results confirm the contribution of classical variables and reveal that especially vocabulary depth seems to be a good predictor of success in early literacy performance. The educational implications of these findings are discussed.
Key words: Dyslexia risks; Preliteracy skills; Prevention; Vocabulary depth.

[es] La profundidad de vocabulario como variable predictora de la lectoescritura

Resumen. El objetivo de este estudio es explorar en una muestra de 162 escolares de 3º de Educación Infantil el valor predictor que desempeña la amplitud y profundidad del vocabulario junto con las variables clásicas de conciencia fonológica, velocidad de denominación y conocimiento alfabético, en la explicación del progreso en el aprendizaje inicial de la lectura y la escritura. La detección temprana de riesgos en el aprendizaje de la lectura resulta esencial para poder intervenir proactivamente si se constatan indicios de dislexia. El estudio de las habilidades que predicen la adquisición exitosa de la lectoescritura puede ser de utilidad para identificar indicadores de riesgo de dificultades de aprendizaje de la lectura y la escritura en Educación Infantil. Los resultados encontrados constatan la contribución de las variables clásicas y revelan que especialmente la profundidad de vocabulario parece ser un buen predictor del éxito en el rendimiento lectoescritor en edades tempranas. Se comentan las implicaciones educativas del conjunto de estos hallazgos.
Palabras clave: Habilidades predictoras de la lectura; Prevención; Profundidad de vocabulario; Riesgos de dislexia.

Sumario: Introduction. Method. Participants. Instruments. Procedure. Results. Discussion. Conclusions. References.

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Introduction

The study of early literacy abilities allows to identify risk variables of future reading difficulties (Catts et al., 2015; De la Calle et al., 2019; Ecalle et al., 2020; Marí-Sanmillán et al., 2019) and soften their impact prior to formal reading instruction. Therefore, it is possible to start the necessary specific teaching in the preschool stage, rather than "wait to fail", as outlined in the Wait To Fail Model, which was based on the criterion of discrepancy. This criterion refers to a discrepancy between the estimated intellectual potential and the actual performance level in relation to basic difficulties in the learning process (Bateman, 1965). In the case of reading, this implies the existence of a two-year gap between the schoolchildren's reading proficiency and that of their reference group. Therefore, it is difficult to carry out any diagnostic before the 3rd grade of primary education. This reactive and belated strategy is detrimental to schoolchildren who are at risk of developing dyslexia because a considerable amount of time is wasted when risks can be detected at an early age. We might think, in line with the Response to Intervention Model (Individuals with Disabilities Education Improvement

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Act, IDEA, 2004), a proactive strategy based on the concept of resistance to instruction, that the early training of different cognitive-metalinguistic skills related to reading acquisition will prepare students to face this complex task (Sánchez et al., 2018; Zijlstra et al., 2021).

There is abundant evidence in the scientific literature which points to metalinguistic skills, and specifically phonological awareness, as the most powerful predictor of reading acquisition (Caravolas et al., 2012; Defior & Serrano, 2011; De la Calle et al., 2016; Kim y Pallante, 2012: Landerl et al, 2019; Melby-Lervåg et al., 2012; Porta et al., 2021; Snowling & Melby-Lervåg, 2016; Suárez-Coalla et al., 2013). These skills come along with the ability to identify the name and sound of the different letters (Bravo-Valdivieso et al., 2001; Clayton et al., 2020; De la Calle et al., 2021; Ferroni et al., 2016; González et al., 2013; Jiménez et al., 2010; López-Escribano & Beltrán, 2009; Muter et al., 2004; Vellutino & Scanlon, 2002), all this contributing to a better acquisition and development of the alphabetic code, which is beneficial for reading and writing learning. In the same vein, the speed of lexical access (hereinafter RAN) is another highly predictive variable of reading and writing acquisition both in transparent and opaque orthographies (Araújo et al., 2015; Defior & Serrano, 2011; González et al., 2015; Jiménez, 2019; Martínez et al., 2021; Ramos-Tresguerres et al., 2021; Suárez-Coalla et al., 2013).

In addition to all these essential skills, the National Institute of Child Health and Human Development (2000) also includes vocabulary as a key component of reading and writing acquisition, which implies that this ability is advantageous for the reading process (Domínguez & González, 2021). Therefore, the influence of vocabulary has proved relevant in higher order reading resources, such as reading comprehension (Binder et al., 2017; Ferroni, 2020; Gallego & Figueroa, 2020; Hjetland et al., 2017; Li et al., 2020; Ouellette & Shaw, 2014; Perfetti & Stafura, 2014; Pezoa y Orellana, 2021; Ricketts et al., 2020; Tran et al., 2020). That is, when the links between phonology, orthography and semantics are sufficiently consolidated, knowledge about the words that make up a text supports the comprehension of what is read. This relationship seems logical, since if the proportion of unknown words in a text is very high, comprehension of what is read will be greatly impaired (Kim & Pallante, 2013). But it is also related to written word recognition processes (Kearns & Al Ghanem, 2019; Kendeou et al., 2009; Mitchell & Brady, 2013; Nation & Snowling, 2004; Perfetti, 2010; Protopapas et al., 2013; Verhoeven et al., 2011; Wise et al., 2007) and, in fact, supports, facilitates and predicts them (Georgiou & Das, 2018; Leseman & de Jong, 1998; Tunmer & Chapman, 2012). This influence can be explained by the fact that vocabulary seems to contribute to the consolidation of the links between the three levels of word representation: orthographic, phonological and semantic (Dujardin et al., 2021), which are the core of orthographic mapping because they allow to forge the word's graphemes, pronunciation and meaning in our memory (Ehri, 2014). A recent study (Duke & Cartwright, 2021) highlights vocabulary as a shared bridging process between oral and written language (word recognition) and thus allows such a mapping (phonology-orthography-semantic) to occur.

As a result, a minimal vocabulary knowledge seems necessary to start reading successfully and, in fact, students with poor vocabulary will experience more difficulties than their peers exposed to rich vocabulary, not only in developing general language skills but also in learning to read (Maassen et al., 2022; Webb & Chang, 2015). To sum up, there is an important consensus about the importance of vocabulary in reading (Oakhill et al., 2019), but what do we mean by vocabulary?

Vocabulary means the collection of words which should be known to effectively communicate (Jiménez, 2019) and it may be receptive or productive. The former refers to the vocabulary understood when heard or when words appear written, and they are read. Productive vocabulary concerns the words that are produced to express ideas. A distinction is also made between vocabulary breadth -number of lexical and phonological entries a person knows- and vocabulary depth -scope of the semantic representation-.

Vocabulary breadth, namely vocabulary size, implies having a general ideal of the word's meaning (Ouellette & Beers, 2010). This knowledge impacts decoding indirectly, as it exerts significant influence on the development of phonological awareness (Ouellette, 2006; Torppa et al., 2010). Hence, Stoel-Gammon and Sosa (2009) suggest that students with a more extensive vocabulary tend to have broader sound and syllabic structure inventories; therefore, the existence of a strong correspondence between students' productive vocabulary and phonological inventory complexity may be considered. In other words, vocabulary increase seems to act as a driving factor for the acquisition of the phonological system (Metsala & Walley, 1998) and, as a result, may indirectly influence word reading through its effect on phonological development (Hoff, 2013). From this perspective, vocabulary knowledge is even considered as a compensatory mechanism for children with poor phonological knowledge (Snowling et al., 2003). This explanation is equally plausible, if not more so, because of the powerful relationship between vocabulary and reading-in deaf children (Kyle et al., 2016).

On the other hand, vocabulary depth encompasses the capacity to relate the word to semantic categories, the rapid access to meanings and the ability to use the word in different constructions (Ouellette & Shaw, 2014; Proctor et al., 2012; Schmitt, 2014). It refers to the degree of knowledge of the multiple meanings of words and their associations (Pan & Ucelli, 2010). Specifically, Alonso-Cortés-Fradejas et al. (2021) point out that this aspect of lexical development is associated with the capacity to access the lexicon quickly and accurately, as well as with lexical organisation; that is to say, with the ability to recognise word associations. Moreover, they

highlight that vocabulary depth embraces the knowledge of polysemic words, synonyms and antonyms, words belonging to the same family and semantic collocations where a word or word type appears next to another one -due to its semantic similarity or structure- over which it dominates and determines its choice. In the same sense, Nagy and Scott (2000) pointed out that knowing a word implies knowing the meaning itself and its various connotations, the different morphological options it offers, the type of syntactic structures it may be part of, and the set of semantic associations: synonyms, antonyms, hyperonyms, hyponyms, etc., as well as its polysemy capacity. Thus, word knowledge can be understood as a continuum from vaguely knowing its meaning to mastering its syntagmatic, analytic and paradigmatic relationships with other words and being able to use it in different contexts (Shuang et al., 2019). Within this context, it is set out that expert readers perform several phonetic-phonological, morphological-syntactic and semantic associations among words, which enable access thereto as well as their rapid activation. Consequently, Proctor et al., (2012) define vocabulary depth as the incorporation of the metalinguistic skills of morphological awareness, semantic awareness, and syntactic awareness to the deep knowledge of words.

In the present study, we would like to focus on semantics as well as revise how word knowledge networks become an important factor for literacy programmes to succeed. Accordingly, thorough understanding of semantics implies that schoolchildren be sensitive to polysemy-related matters through academic and social contexts, to how different words are linked through context (e.g., ambulance/hospital) and to specific meanings of different concepts (Proctor et al., 2012). These ideas combined raise the fact that vocabulary depth in reading acquisition seems to be relevant when conferring further consistency to the orthographic representations of words. In other words, a more thorough knowledge of vocabulary allows schoolchildren to have a sound network of associations among concepts (Moreira, 2012), which facilitates word decoding and retrieval due to the rapid availability of verbal mediators. In this respect, it is considered that meanings of words represented in more detail will be more accessible as a deeper vocabulary knowledge may reflect a faster decoding, organisation, and retrieval of phonological representations of words (Ouellette, 2006; Wise et al., 2007).

Finally, it is to be highlighted that in the case of writing, vocabulary knowledge is also highly beneficial, as it contributes to writing words in general and to writing orthographically irregular words (Ouellette, 2006; Ricketts et al., 2007). Models of writing development (Berninger et al., 2002; Juel et al., 1986) indicate that the speed at which schoolchildren access the orthographic representation of words facilitates written production. Therefore, although a remarkable correspondence between vocabulary knowledge and successful writing is observed (Asaad & Shabdin, 2021), it is yet to be clarified whether it is the breadth or the depth of this component the one that influences word writing. As far as text quality is concerned, recent studies (Alonso-Cortés-Fradejas et al., 2021; Castillo & Tolchinsky, 2018; Gómez-Vera et al., 2016; Tolchinsky, 2019) seem to indicate that deep knowledge of words is the ability that most significantly contributes to written production.

Consequently, schoolchildren with an extensive and deep vocabulary should be capable of accessing and retrieving more specific and redundant orthographic and phonological representations of words, which results in further fluency when identifying and/or retrieving them. Thus, it can be argued that vocabulary breadth and a deeper knowledge of semantic and syntactic relations of the words schoolchildren may have acquired in their oral language development will enable sound discrimination and word recognition, thereby facilitating the mental manipulation required for their understanding and, consequently, will benefit subsequent reading and writing performance (Bohórquez et al., 2014).

Most studies supporting the ideas set out above derive from opaque languages. On the other hand, in Spanish, research has been performed on reading comprehension (Ripoll & Aguado, 2015; Strasser et al., 2013; Tapia, 2017), text quality (Alonso-Cortés-Fradejas et al., 2021) and influence of this ability on reading strategies used by deaf students (González & Domínguez, 2018); therefore, the contribution of vocabulary to reading fluency and to written production in transparent orthographies has not been accurately established yet. Therefore, this study is mainly aimed at analysing the predictive role of vocabulary breadth and depth in word reading and writing of early childhood education students in a transparent language such as Spanish. As secondary aims, the study intends to ratify the predictive role of classical variables, namely phonological awareness, rapid naming and letter name and sound knowledge.

These aims lead to the following main hypotheses:

- Hyp. 1 Students with increased vocabulary breadth are better performers when they start learning to read and write.
- Hyp. 2 Students who have two or more meanings for the same word (vocabulary depth) show better skills when they start to read and write.

Secondary hypotheses:

- Hyp. 3 Schoolchildren with increased phonological awareness are better performers when they start learning to read and write.

- Hyp. 4 Schoolchildren with more rapid naming skills show better skills when they start to read and write.
- Hyp. 5 Schoolchildren with more letter name and sound knowledge are better performers when they start learning to read and write.

Method

Participants

The sample is made up of 162 students (75 girls and 87 boys) belonging to the third year of early childhood education from nine public schools located in five towns in the province of Salamanca, Spain. The mean age of the participants is 67.38 months (SD 3.56), 5 and a half years old and 95% of them are native Spanish speakers, the remaining 5% are children of immigrants of other languages but the students speak Spanish correctly. 94.4% of them live in a structured home and 87.2% belong to a middle-class environment where they receive schooling support. Exclusion criteria were deafness, profound visual impairment, and known neurological disorders such as cerebral palsy, epilepsy, specific language impairment, and autism spectrum disorder. The sample is intentional and not preselected.

Instruments

Instruments used to assess the performance of schoolchildren are detailed in Table 1.

Table 1. Relationship between measured variables and tests used

Measured variables	Tests used
Reading and writing	– Word and pseudoword reading test (UADLE, 2020). – Word and pseudoword writing test (UADLE, 2020).
Phonological awareness	– Speech sound counting and identification test (UADLE, 2020).
Letter name and sound	– Letter name and sound recognition test (UADLE, 2018).
Speed of lexical access (RAN)	– Colour rapid naming test (UADLE, 2017). – Digit rapid naming test (UADLE, 2017). – Object rapid naming test (Fernández-Pinto et al., 2013).
Vocabulary: breadth and depth	– Vocabulary test of the Wechsler Intelligence Scale for preschool and primary school (WPPSI-IV, 2005). – Multiple meaning test (UADLE, 2020).

Word and pseudoword reading

A test is prepared (UADLE, 2020) including two pseudowords and eight words, four out of which were taken from the DST-J test adapted to Spanish (Fernández-Pinto et al., 2013) and the rest were chosen based on inter-judge reliability considering criteria of familiarity or frequency, length, and complexity of syllabic structures.

Word and pseudoword writing

Writing is assessed through a specifically created test (UADLE, 2020) made up of six words and two pseudowords. The first four words have been taken from the DST-J test (Fernández-Pinto et al., 2013) and, for the preparation of the remaining stimuli, criteria identical to those used for the reading test were used.

Phonological awareness

To assess phonological awareness, a speech sound counting and identification test (UADLE, 2020) is used, consisting of six items and combining three above-mentioned criteria, that is frequency, syllabic structure and length, for its performance. After the oral production of the word evaluator takes place, the schoolchildren are asked to count the number of speech sounds of the word and identify which is the initial and the final sound.

Alphabetic knowledge

Letter name and sound knowledge is assessed through a test (UADLE, 2017) comprising a total of thirty items to which the schoolchild is to respond by producing the name of the letter and its corresponding sound. Completion time and total correct answers and errors in letter recognition and sound production are obtained.

Speed of lexical access

Three tasks have been used for the assessment of this ability. The first two, made up of 28 items respectively (colour RAN and digit RAN), were specifically drafted by the UADLE (2017) and the third, comprising a total of twenty stimuli (object RAN), was adapted from the one belonging to the DST-J test (Fernández-Pinto et al., 2013).

Vocabulary: breadth and depth

Assessment of productive vocabulary of schoolchildren is performed through two tasks. The vocabulary breadth subtest belonging to the Wechsler Scale for preschool and primary school (WPPSI-IV, 2014) and a multiple meaning test (UADLE, 2020) drafted *ad hoc* to assess vocabulary depth through different stimuli with two or more meanings to which students are to respond by identifying the different meanings of one single word with the highest level of accuracy. The test is composed of a total of fourteen words of target students' everyday life as they were extracted from children's stories. To correct the task, correction criteria were set as agreed by evaluators considering both accuracy and number of meanings in the schoolchildren's answers.

Procedure

Assessment was conducted by a trained evaluator in a quiet environment during school hours. Each test was performed individually and in the same order for all participants. The sessions lasted approximately 35 minutes, thus avoiding the fatigue of the participants.

The tests' order and application criteria are defined based on a pilot study. This first initial study was carried out with six students in one of the schools selected for the assessment and was useful for adjusting the different tests in terms of the type of competencies to be assessed and the way in which they were carried out. In this context, it was decided to discard a lexical awareness test initially included because it proved not to discriminate among students. Similarly, the response mode in the phonemic awareness test was replaced because it was found to be very complicated and confusing for the students. Thus, instead of having to make crossings according to the number of sounds identified, it was decided that it was sufficient for them to express the number orally. Finally, the difficulty of the reading and writing tests was increased because it was found that they did not allow discriminating between good and bad reading and writing competence. Specifically, the length and difficulty of the syllable structure were increased.

The correction of the tests is carried out by two researchers based on pre-established criteria. The data obtained has been anonymized and analysed with SPSS 26 using a multiple regression analysis methodology, which allows establishing the relationship and influence between the variables evaluated and the development of students' early literacy. In carrying out this research and data processing, the regulations of the bioethics committee of the University of Salamanca have been followed. The schools were also informed, and informed consent was obtained from each and every one of the families involved in the study.

Statistical Analysis

First, Pearson's bivariate correlation analysis is performed to determine the extent to which the variables are related to each other and especially to the students' reading and writing performance. As central analysis, a stepwise multiple regression analysis is included to test the independent contribution of each of the variables in explaining the onset of learning to read and write. Considering the theoretical models on learning to read and its difficulties, we predict that the variable that is most related to writing and reading will be phonological awareness (phoneme counting and identification), followed by alphabetic knowledge and naming speed, and finally vocabulary.

Results

The Pearson bivariate correlation analysis and the stepwise multiple regression analysis are incorporated for each dependent variable (reading and writing).

Correlation analysis

Table 2 includes Pearson correlation analyses performed to show the degree of association among the different variables targeted by the study, word reading and writing, letter name and sound, speech sound identification in initial and final position, speech sound counting, vocabulary breadth and depth, and colour, digit, and object naming speed.

Table 2. Correlation among variables

Variable	Mean	SD	1	2	3	4	5	6	7	8	9	10
1. RDG	4.72	2.45										
2. WRTG	3.09	1.99	.751**									
3. VOC.B	18.31	5.89	.359**	.338**								
4. VOC.D	8.30	5.49	.507**	.505**	.565**							
5. SP. SND COUNT.	2.15	1.94	.503**	.550**	.244**	.418**						
6. SP. SND ID.	7.05	4.09	.558**	.583**	.328**	.415**	.639**					
7. LTR NAME K.	21.78	6.43	.673**	.617**	.387**	.403**	.364**	.420**				
8. LTR SND K.	19.68	7.38	.622**	.630**	.400**	.446**	.445**	.571**	.612**			
9. C. RAN	33.46	11.94	-.227**	-.224**	-.212**	-.313**	-.335**	-.247**	-.217**	-.309**		
10. D. RAN	27.65	10.91	-.435**	-.392**	-.266**	-.312**	-.326**	-.308**	-.436**	-.382**	.520**	
11. O. RAN	27.47	8.22	-.219**	-.158*	-.306**	-.340**	-.194*	-.184*	-.168*	-.311**	.626**	.359**

Note. * p<.05, **p<.01

RDG (Word and pseudoword reading) / WRTG (Word and pseudoword writing) / VOC. B. (Vocabulary Breadth) / VOC. D. (Vocabulary Depth) / S. SND. COUNT (Speech Sound Counting) / S. SND ID. (Speech Sound Identification) / LTR NAME K. (Letter name knowledge) / LTR SND K. (Letter sound knowledge) / C. RAN (Colour rapid naming) / D. RAN (Digit rapid naming) / O. RAN (Object rapid naming).

It is observed in this study, in line with existing research, that the variables which are most related to word reading and writing are letter name and sound knowledge, phoneme identification, vocabulary depth and rapid digit naming.

Regression analysis

To measure the extent to which reading and writing can be explained by the variables mentioned above, a stepwise multiple regression analysis is carried out for each dependent variable, as shown in Tables 3 and 4.

Table 3. Word reading multiple regression analysis

	R2	ΔR2	F	β	t	Tolerance	VIF
Model 1	.469		134.273**				
Letter name knowledge				.685	11.588**	–	–
Model 2	.557	.088**	95.037**				
Letter name knowledge				.547	9.150**	.822	1.217
Speech Sound Identification				.328	5.486**	.822	1.217
Model 3	.587	.030**	71.063**				
Letter name knowledge				.491	8.140**	.757	1.321
Speech Sound Identification				.270	4.467**	.753	1.328
Vocabulary depth				.197	3.285**	.765	1.307
Model 4	.605	.018**	56.995**				
Letter name knowledge				.412	6.175**	.597	1.675
Speech Sound Identification				.205	3.183**	.639	1.566
Vocabulary depth				.174	2.914**	.748	1.338
Letter sound knowledge				.190	2.588**	.494	2.023
Model 5	.617	.012**	47.627**				
Letter name knowledge				.374	5.482**	.557	1.795
Speech Sound Identification				.195	3.058**	.635	1.574
Vocabulary depth				.162	2.735**	.741	1.349
Letter sound knowledge				.178	2.446**	.491	2.035
Digit rapid naming				-.124	-2.149**	.778	1.285

*$p < .05$, **$p < .01$

Note. ΔR2: R Square Change. β : Standardised coefficients beta. Tolerance: Collinearity Statistics. VIF: Variance Inflation Factor.

As observed in Table 3, concerning the reading variable, the first model shows that letter name knowledge accounts for 46.9% variance. In the second step, the value R2 goes up to .557, which indicates that the speech sound identification variable significantly contributes to the explanation of variance in word reading. When vocabulary depth is introduced in the third model, it may be concluded that it accounts for 58.7% variance in word reading. The fourth model adds letter sound knowledge, a variable which also contributes significantly to account for the behaviour of the dependent variable. Introduced at the end, rapid digit naming also seems to contribute significantly to this explanation. Generally, the five variables selected in the final model manage to account for 62% R2 = .617 of the variability observed in reading, and all of them contribute significantly to the explanation of word reading. As shown in Table 3, in all models the VIF values are all well below 10 and the tolerance statistics all well above 0.2; therefore, we can safely conclude that there is no collinearity within our data. The Durbin Watson test indicates that for these data the value is 1.860, which is so close to 2 that the assumption of the independent errors has almost certainly been met.

As shown in Figure 1, the scatter plot shows the relationship and predictive ability for reading of the variables letter name knowledge, speech sound identification, vocabulary depth, letter sound knowledge and digit rapid naming.

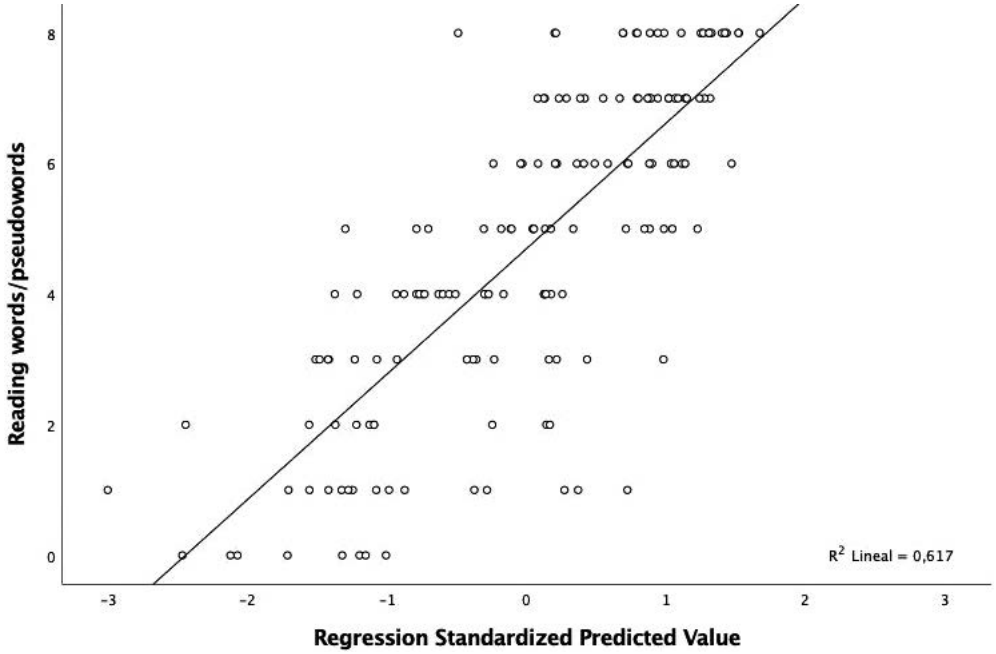

Figure 1. Regression function - Reading

Table 4. Word writing multiple regression analysis

	R2	ΔR2	F	β	t	Tolerance	VIF
Model 1	.430		114.472**				
Letter sound knowledge				.655	10.699**	–	–
Model 2	.517	.088**	80.869**				
Letter sound knowledge				.426	5.947**	.624	1.602
Letter name knowledge				.375	5.234**	.624	1.602
Model 3	.582	.065**	69.530**				
Letter sound knowledge				.328	4.704**	.572	1.749
Letter name knowledge				.329	4.878**	.612	1.634
Speech sound counting				.285	4.810**	.792	1.262
Model 4	.600	.018**	55.890**				
Letter sound knowledge				.295	4.230**	.552	1.810
Letter name knowledge				.300	4.471**	.595	1.680
Speech sound counting				.245	4.080**	.742	1.349
Vocabulary depth				.159	2.616**	.730	1.370

*$p < .05$, **$p < .01$

Note. ΔR2: R Square Change. β: Standardised coefficients beta. Tolerance: Collinearity Statistics. VIF: Variance Inflation Factor.

As observed in Table 4, regarding the writing variable, the first model shows that letter sound knowledge accounts for 43% variance. In the second step, when adding the letter name knowledge variable, the value R2 goes up to .517, which allows to state that this variable significantly contributes to the explanation of variance in word writing. In the third model, the speech sound counting variable is added, which also contributes significantly to account for the behaviour of the dependent variable. When vocabulary depth is introduced in the fourth model, there is a significant increase in ΔR2 of 0.018. Overall, the four variables selected in the final model manage to account significantly for 60% (R2 = .600) of the variability observed in writing. As in the case of the multiple regression with word reading, in the models with the writing variable (see table 4), the VIF values are well below 10 and the tolerance statistics are well above 0.2; therefore, we can certainly conclude that there is no collinearity within our data. As in the case of the regression model with the reading dependent variables, in the regression model with the writing variables the Durbin Watson test (DW = 2.029) also shows the residuals in the model are independent.

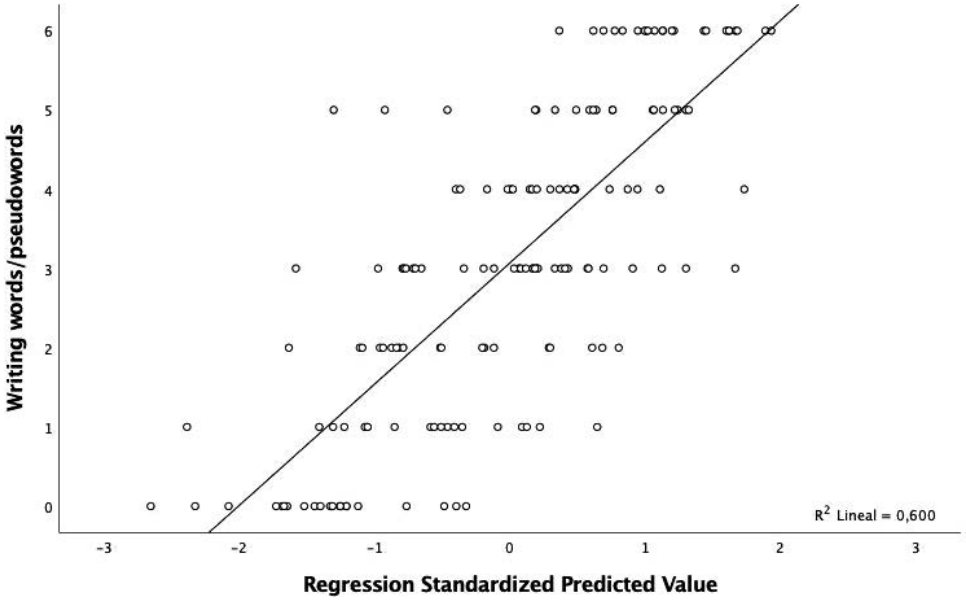

Figure 2. Regression function - Writing

As shown in Figure 2, the scatter plot shows the relationship and predictive ability for writing, of the variables letter name and sound knowledge, sound counting and vocabulary depth.

Overall, these data suggest that word and pseudoword reading and writing may be explained by letter name and sound knowledge and vocabulary depth variables. Specifically, reading is also explained by digit rapid naming and phoneme identification and writing by speech sound counting.

Discussion

The main purpose of this study has been to test the predictive effect of vocabulary on reading and writing development, and assess whether this ability makes a specific and differentiated contribution as compared to that delivered by phonological awareness, naming speed and alphabetic knowledge, having these variables been widely contrasted in several studies (Cuetos et al., 2012; González-Valenzuela et al., 2016; Gutiérrez, 2018; Jiménez, 2019; Slomowitz et a., 2020; Snowling & Melby-Lervåg, 2016; Suárez-Coalla et al., 2013). In this regard, the present research also examines the contribution of the above-mentioned abilities and, hence, allows to verify its relevant predictive value for initial reading and writing performance. All results are consistent with those accomplished by Caravolas et al. (2013), Clayton et al. (2020) or Ferroni et al. (2016) and allow us to confirm hypotheses three, four and five of this study.

Specifically, the data obtained show that the knowledge of alphabet letter sounds help elaborate on the performance in word and pseudoword writing whereas, in the case of word and pseudoword reading, the additional letter name knowledge schoolchildren have is observed as a better predictor, which is consistent with the research performed by De la Calle et al. (2018), Piasta et al. (2012) or Torppa et al. (2010), from which it is possible to interpret that letter knowledge is a strong predictor variable of word and pseudoword reading in preschool and primary school. Furthermore, it is interesting to observe the different contribution provided by letter name and/or sound knowledge in accordance with the studies performed by Ellefson et al. (2009) or Ferroni and Diuk (2010).

Similarly, as might be expected, an interesting contribution of phonological awareness is observed (measured through two tasks, one of phoneme identification in initial and final position and the other of phoneme counting) to the explanation of reading and writing development, in line with other studies (Clayton et al., 2020; De la Calle et al., 2021; Hulme & Snowling, 2013). Moreover, this study also shows that phonemic awareness, measured through the phoneme identification task, is related to the reading performance of schoolchildren. When this competence is evaluated using a more demanding task than phoneme identification, such as phoneme counting, phonemic awareness shows a much more direct and close relationship with writing than with reading. This idea was already present in some intervention studies (Rueda et al., 1990), where it was observed how intervention in phonemic awareness resulted in more positive and beneficial effects on writing improvement than in word and pseudoword reading of students with dyslexia.

Another hypothesis raised by this research refers to the contribution of RAN to reading and writing development. It is confirmed that schoolchildren participating in the study with better RAN skills perform better when they start their reading instruction, which seems to suggest that both skills rely on shared cognitive processes (Landerl et al., 2019). Essentially, rapid digit retrieval is the skill showing the best explanatory power. This becomes more meaningful if it is considered that the left angular gyrus region is involved both in letter name identification and retrieval and in number processing (Serra-Grabulosa et al., 2010). These data match those of other studies (Araújo et al., 2015; Martínez et al., 2021) which set out that rapid naming is built as a significant prereading skill. Consequently, schoolchildren who perform worse in this kind of task will be more likely to suffer from reading disabilities (Swanson et al., 2016). As far as writing is concerned, the results match the research performed by Suárez-Coalla et al. (2013) as no remarkable effects of RAN tasks were observed on writing development. However, some studies suggest that there is certain influence (Plaza & Cohen, 2004), hence these results are to be interpreted carefully, more research being necessary in this regard.

As for the influence of vocabulary, it is important to point out that the main contribution of this study is that it helps elucidate the predictive capacity of the vocabulary variable in the acquisition of reading and writing. In this regard, the present research suggests that vocabulary breadth, but especially vocabulary depth, seems to become a relevant variable -both in reading and in writing-, thereby confirming two of the hypotheses raised in hypothesis 1 and 2 of this study.

Vocabulary depth shows a good predictive capacity of word and pseudoword reading and writing in 5-year-old preschool children. These findings seem to match those obtained in the research performed by Eason et al. (2013) with 10-to-14-year-old students, in the one conducted by Nation and Snowling (2004), or in the work published by Ricketts et al. (2016) and Ouellette and Beers (2010), where it was observed that in samples of 5-to-7-year-old boys and girls, vocabulary depth was a significant prereading skill of irregular words.

Regarding the variable vocabulary breadth, other studies have highlighted its predictive role in learning to read and its influence on the development of phonological awareness (Duff et al., 2008; Lee, 2011; Ouellette, 2006; Ouellette and Shaw, 2014; Torppa et al., 2010). However, in this study it is overshadowed and fails to join the regression line if the variable vocabulary depth is also introduced. This is so, as Ouellette (2010) and Li et al. (2020) pointed out, perhaps because vocabulary depth is a more sensitive predictor than breadth for early school-age children. That is, younger children are more likely to store new words quickly, but not all of them have a full and deep meaning. Furthermore, considering that word reading involves the storage and retrieval of orthographic representations, it may be that a richer and more complete semantic representation helps this process more than the breadth of vocabulary.

What is interesting about this study and other matching ones is that they identify what seems to be a direct association between vocabulary depth and word reading, apart from the contributions of other skills studied and overtaking vocabulary breadth. As noted above, it seems that the differential contribution of vocabulary with respect to the rest of the variables seems to be given by its influence on both word recognition and oral language comprehension (Duke & Cartwright, 2021), two interrelated domains for reading comprehension according to the Simple View of Reading (Gough & Tunmer, 1986). This differential and specific contribution of vocabulary to the reading ability has already been found in other studies (Nation & Snowling, 2004; Ouellette & Beers, 2010) and, in fact, recent research indicates that this ability predicts reading fluency and dyslexia (Maassen et al., 2022).

In this sense, it seems that deep word knowledge itself is a broad concept that makes it possible to link the three levels of word representation (Perfetti, 2007) and rapidly access from one to the other (fluency and network organisation dimensions), which helps recognize and decode words more quickly and easily (Dujardin et al., 2021). That is, the vocabulary depth reflects how well words are organised in the mental lexicon (Afshari & Tavakoli, 2016). As a result, we agree with Ouellette and Shaw (2014) in that integrity and organisation of the lexical-semantic system is a critical factor in word reading and writing, as it shows the importance of semantic network cohesiveness in reading (Nation & Snowling, 2004) and, according to the lexical quality hypothesis (Perfetti, 2007), the results of the present study seem to reflect the role of mutually integrated and connected representations in efficient reading. That is, what we know about words before reading prepares us to recognize more quickly even the visual forms of individual words, as well as to understand their meanings more accurately and rapidly, and transfer them to a new context (Wolf, 2020).

In the light of the results obtained on the influence of vocabulary depth, it is also conceivable to think that those schoolchildren who know more meanings will have better morphological awareness. This ability to reflect on meaningful units underpins reading fluency through vocabulary knowledge (Rueda & Medina, 2018). In other words, when schoolchildren understand why some words are written in a certain way and what their meanings are, phonological, orthographic, and semantic representations stored in their lexis become stronger and redundant. As a result, it is possible to state that knowing words' morphological bases reinforces the links between orthographic and phonological representations and between said links and the meaning of the word (Medina, 2017). Thus, in line with Lázaro et al. (2021) it is considered of interest that future research delves into the interrelationship between vocabulary and morphological awareness and its role in reading fluency.

Therefore, it is concluded that working on the deep knowledge of words from early ages can be beneficial to promote the learning of reading and writing.

Conclusions

This study provides interesting information on the role of some basic skills needed for reading acquisition. Moreover, these skills -phonological awareness, RAN, letter name and sound knowledge, and vocabulary depth- are to be considered in detecting and preventing disability risks in reading and writing acquisition at an early age. Accordingly, the present study is informative about the concurrent relationship among these variables and leads to results analogous to previous research on the subject, so it is possible to consider the set of implications for educational practice obtained from the said results.

Specifically, although it is known that working on vocabulary is of vital interest from a very young age to promote proper development and access to oral and written discourse comprehension, the results obtained in this study suggest that this vocabulary knowledge is also very important for a more accurate word and pseudoword reading and writing. In this regard, prevention programmes aimed at students who are at risk of developing reading disabilities must focus on improving oral language skills, especially vocabulary knowledge, as well as on their phonological and alphabetic coding skills (Tunmer & Chapman, 2012). As a matter of fact, the results of several research studies reveal the effectiveness of vocabulary instruction in students at risk of developing disabilities or not, at an early age (Dickinson et al., 2019; Porta & Ramírez, 2020).

It is deducted from the present study that the development of semantic and phonological language components of preschool students is directly related to the development of written language, and it is possible to conclude, in agreement with Vega (2010), that those schoolchildren with more language structure awareness will learn to read more easily than those with a less developed aforementioned awareness. Thus, it is recommended that different skills required for reading accuracy and comprehension are fostered in the school setting. Among said skills, letter name and sound knowledge, phonemic awareness and vocabulary are to be highlighted, the development of the latter being a requirement for reading and reading comprehension (Duff et al., 2008; Duff et al., 2015; Rueda, 2017; Strasser et al., 2013).

Limitations and foresight

The pattern of the results obtained in this study seems to be consistent and concurring with previous research work. Nevertheless, the limitations deriving thereof emphasise the need that future research studies should assess the predictive power of the variables herein identified as relevant in the initial learning of reading and writing for levels higher than third year of pre-school. This study is predominantly about the influence of vocabulary on the initial learning of reading and writing. Its contribution from a longitudinal perspective should be further explored to know how it varies as students move forward in their educational journey, their progress in reading and writing acquisition and reading comprehension also varying as a result. Moreover, it would be of interest that future research studies look into vocabulary depth more thoroughly by adding tasks other than the polysemic lexis used herein. However, it is not easy to identify the best options as this variable is conceived as a lexical development dimension where different types of knowledge and abilities are interrelated (Alonso-Cortés-Fradejas et al., 2021; Nagy & Scott, 2000), and the existing studies specifying the concept of this vocabulary depth construct are still scarce. Concerning the need to overcome the possible limitations of the present study and the idea of digging into the vocabulary depth dimension, it would be interesting that future studies differentiate not only vocabulary breadth and vocabulary depth but also expressive and receptive vocabulary. Thus, special emphasis could be placed on assessing whether vocabulary depth is related to word decoding and recognition skills (Ouellette, 2006) in elementary schoolchildren and, specifically, whether receptive and expressive vocabulary depth contribute differently in this regard.

Another significant limitation of the study may derive from the selected statistical method, i.e., stepwise regression. Although it is one of the most widely used and highly regarded research methods to find the best predictors, it has also met with some criticism (Keith, 2019). For example, it may well indeed be that if two inde-

pendent variables correlate with each other, only one of them is added in the regression function. This could be an alternative explanation to the one previously offered in this study to the fact that the vocabulary depth variable be added in the regression function rather than the vocabulary breadth variable. In these cases, it is advisable to join related variables, but the aim of this research study was to assess the effect of each of these vocabulary variables. Another main critical observation of the stepwise regression method is that it performs the selection of variables added in the regression line based on purely statistical criteria without taking into account theoretical considerations. This is an extremely important aspect. Nevertheless, the variables included in the model suggested herein are not random; in fact, they are selected and highly supported by theory. Finally, another methodological aspect that should be considered could be related to the size of the sample. Although the size of the present sample is acceptable, it would be interesting to enlarge it as far as the number of defined predictors is concerned, with the purpose of obtaining more statistical power in the findings (Miles & Shevlin, 2001).

Ultimately, it is considered that, despite the limitations analysed, the present study may have implications in educational practice. This is because the identification of reading performance predictor variables enables the early detection of risks during the first school years and allows to conduct specific and preventive interventions when it comes to learning disabilities (Catts & Hogan, 2021; Dehaene, 2014; Jiménez, 2019; Panalés & Palazón, 2020). Consequently, this knowledge acts as a good starting point not only to tackle the disability at an early age but also to minimise its consequences at an individual, family, academic, social and emotional level.

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Competing interests

The authors have not mentioned any potential competing interest concerning the present article.

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