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How important is Language Development for Skilled Reading? Exploring the Relationship between Language Processes and Reading Skills for Children with Dyslexia

It is well documented that phonological difficulties are a recurring challenge for those with dyslexia. However, there is less focus on the important meaning-related processes associated with skilled reading such as language skills and reading comprehension. This paper draws on some of the results of a doctoral study investigating the reading and cognitive profiles of children with dyslexia to highlight the continuing need for a focus on the development language skills for these children.

Keywords: *dyslexia, language skills, semantic, syntactic processing, mental lexicon, meaning-related processes*

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INTRODUCTION

The importance of reading skills cannot be underestimated. The ability to decode, produce and understand written language is crucial for successful participation in modern society (McGill-Franzen, 2011; Wolf, 2008). Poor reading skills can have significant consequences for an individual's participation in education (Department of Education and Skills [DES] 2011; Paris, 2005) and individuals who struggle with reading are frequently unable to reach their potential in life (Barth, Catts & Anthony, 2009; McGill-Franzen, 2011; Reschly, 2010). It has been acknowledged that poor readers receive less practice in reading in school than other children, and thereby miss opportunities to develop important reading comprehension strategies (Nation, 2005; Reschly, 2010) and opportunities for vocabulary development (Cain & Oakhill, 2011).

Evidence suggests that language skills such as vocabulary are key predictors of reading development (Kirby, Desroches, Roth & Lai, 2008) as well as important

factors in skilled reading comprehension (Biemiller, 2011; Wagner, Muse & Tannenbaum, 2007). Therefore, it is important to understand the role of meaning-related skills such as vocabulary development in reading achievement, so that appropriate academic support and interventions can be provided for children who struggle to learn to read.

In this article, I will focus specifically on the importance of language skills in reading achievement; particularly vocabulary, in the context of some findings from a doctoral study investigating the cognitive and reading profiles of children with dyslexia (Reynor, 2016).

LITERATURE REVIEW

The phonological theory is the most developed and researched causal theory of dyslexia (Snowling & Hulme, 2011). It is generally agreed that the majority of children with dyslexia have underdeveloped phonological skills compared with their average-reading peers (Cain, 2010; Vellutino, Fletcher Snowling and Scanlon, 2004). According to LaBerge and Samuels (1974), weaknesses in phonological and decoding skills inhibit the development of fluent reading and reading comprehension. In their influential model of automaticity, LaBerge and Samuels (1974) suggest that as children gain experience and practice in reading, they develop proficiency in their decoding and word recognition skills, allowing them to use their limited cognitive and attentional resources to make meaningful connections within the text (Rasinski, 2012. Automaticity theory has often been used to explain the relationship between skilled word recognition and reading comprehension (Hudson, Pullen, Lane & Torgesen, 2009; Schwanenflugel & Ruston, 2007; Wolf & Katzir-Cohen, 2001). However, we know that reading comprehension is not a simple matter of automatic recognition of words in text (Nation, 2005). Theories of reading describe the complex process of comprehension as requiring a range of higher-order cognitive skills which enable the reader to create mental representations of text, which, in turn, need the integration of information across a range of sources such as meaning-related processes (Kintsch, 2013; Perfetti & Stafura, 2014; Swanson, Zheng & Jerman, 2009; Zwaan, 2008).

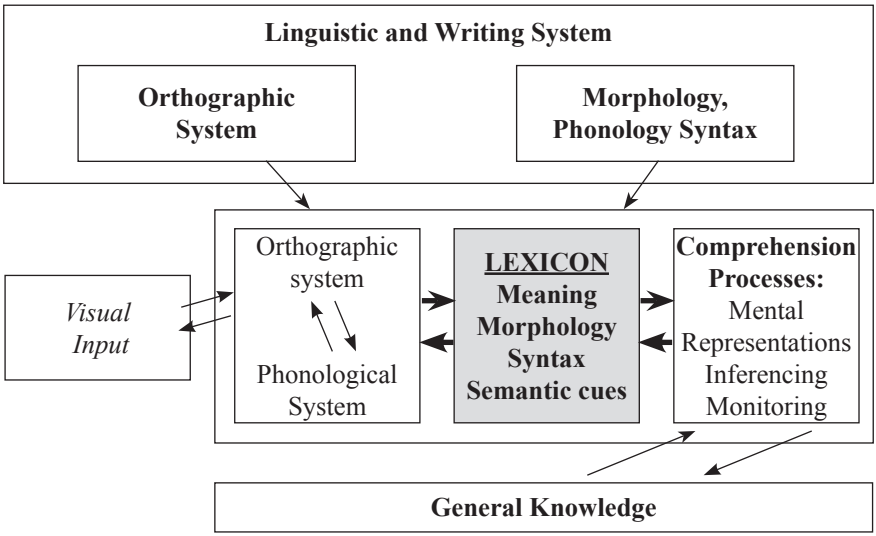
LANGUAGE PROCESSES AND READING COMPREHENSION

The Reading Systems Framework

One model of reading that takes into consideration the complexity of processes involved in reading comprehension is the Reading Systems Framework (RSF)

(Perfetti & Stafura, 2014). This model proposes that the understanding of text calls upon both bottom-up word recognition processes, and top-down comprehension processes such as memory and executive control (Perfetti & Stafura, 2014). According to this model, the reader creates a mental image of the text, sometimes called a situation model (Kintsch, 2013), which integrates text information with the reader's prior knowledge (Kintsch & Rawson, 2005; Zwaan, 2008). Importantly, this model places word and meaning-related processes central to the development of reading comprehension (See Figure 1).

Figure 1: The Reading Systems Framework (adapted from Perfetti & Stafura, 2014)



The Reading Systems Framework identifies three important sources of knowledge for the reading process: linguistic knowledge, orthographic knowledge, and general background knowledge (Perfetti & Stafura, 2014). Different processes support readers to use and combine these sources of knowledge in order to understand written texts. For example, bottom-up processes such as word identification skills, such as the ability to decode, are necessary to make sense of written text. Meaning retrieval, in turn, is required to combine the single words into a meaningful passage of text. According to the Reading Systems Framework, reading comprehension begins with translating visual input (i.e., the words in the text) to phonological

units. Next, interaction with the mental lexicon (our mental dictionary of known words which have been stored in long-term memory, which includes information about morphology, syntax and semantics) leads to word identification (i.e., fluent and accurate recognition of the written words). Subsequently, the linguistic system aids in higher-level comprehension processes, such as inference making and forming a representation of the text (or a situation model of the text).

Word Knowledge and Syntactic Processing

Importantly, in the Reading Systems Framework, the mental lexicon plays a central role in reading comprehension. Each representation corresponds to a word known to a lesser or greater degree, resulting in individual vocabularies of known words. Research indicates that skilled readers differ from less skilled readers in both the quality and quantity of these lexical representations and knowledge of word meanings (Ouellette & Beers. 2010; Perfetti, 2007). Skilled readers have a broader range and knowledge of words compared to less skilled readers, which emphasises the importance of a well-developed lexicon for reading comprehension. Therefore, individual differences in reading achievement cannot solely be attributed to decoding ability (Lesaux & Harris, 2013; Nation, 2005), as skilled reading also depends on knowledge of word meanings (Biemiller, 2011; Kucan, 2012; Perfetti & Stafura, 2014). In addition, not only the number of words a child knows, but also how well words are known, is important in building an understanding of the meaning of a text (Cain, Oakhill & Elbro, 2015; Ouellette, 2006; Wagner et al., 2007).

Other text features that facilitate comprehension, as noted in the Reading Systems Framework, are syntactic phrasing ability and semantic cues, which support the recognition of words and help the reader construct meaning from a text (Cain, 2007; Mokhtari & Thompson, 2006; Nation & Snowling, 2000).

Skilled readers verbally segment word strings into larger syntactic groupings which serve to support comprehension (Cain, 2007; Rasinski, Homan & Biggs, 2009). Indeed, Mokhtari and Thompson (2006) propose that childrens' ability to understand syntax (e.g., to chunk language into meaningful phrases) may have as great an impact on reading achievement as decoding and word identification skills. For example, with the sentence '*As John dived from the cliff top into the ocean he was very afraid',* the reader must have syntactic awareness to pause after *'ocean'*. In addition, if the word *'ocean'* is not in the mental lexicon, the reader might be prompted by the semantic cue *'dived'* and '*cliff top'*. Similarly, if the reader does not recognise the word *'afraid'* as it is not in the mental lexicon and not easily decoded, if the first two sounds can be decoded *'af'*, it is likely to be prompted to recognise the word *'afraid'* from the meaning and context.

Language Processes and Children at risk for Dyslexia

A range of studies have investigated the relationship between early language development and later reading difficulties in children at risk for dyslexia. For example, Scarborough's (1990) seminal six year longitudinal study involving 52 children in the United States, 40 of which were at familial risk for dyslexia, found that children at family risk of dyslexia who went on to develop dyslexia, used shorter, syntactically less complex sentences, with less accurate pronounciation at age two and a half years, than children not at risk for dyslexia. Furthermore, syntactic difficulties remained in subsequent years and were accompanied by vocabulary difficulties. Similar findings emerged from a five year longitudinal study of 107 children at familial risk for dyslexia in Finland (Lyytinen et al., 2004). Children at familial risk for dyslexia demonstrated a developmental delay in structural aspects of language and in vocabulary, using shorter sentences at two years old, and poorer vocabulary growth at age five. In the UK, in a longitudinal study of children of familial risk for dyslexia, Muter and Snowling (2009) found that children who went on to have difficulties with reading at 6 years old, demonstrated weaknesses in their vocabulary development and their expressive language at four years old. Those children with the best outcomes in reading had greater verbal ability. Similar findings were reported by Snowling, Gallagher and Frith (2003), where slower vocabulary development, poor expressive language and grammatical skills were found in children at risk for dyslexia at 3.9 years old. These studies demonstrate that there are potential weaknesses in language development for many children who go on to develop reading difficulties from an early age. It also shows the important relationship between language skills and reading development.

THE STUDY

Sample and Methodology

This was a quantitative study using an ex post facto, nonexperimental design as the framework for the collection and analysis of the data. In ex post facto designs, a random sample is not sought, as the sample is grouped on the basis of certain alreading existing characteristics (e.g., reading difficulties, lack of phonological processing skills, slow naming speed difficulties). The sample involved in the study consisted of 72 children with well established reading difficulties. These children, aged between 11 and 13 years old were recruited from mainstream schools, reading schools and reading units in mainstream schools in suburban Dublin. A small group of 22 age-matched average-achieving readers from the mainstream schools involved in the study was also included.

Purpose of the Study

The purpose of the study conducted by Reynor (2016) was to investigate the subgrouping mechanism known as the double-deficit hypothesis (DDH) (Norton & Wolf, 2012; Wolf & Bowers, 1999). Wolf and Bowers (1999) argue that individuals with dyslexia can be divided into three subgroups:

- those with phonological difficulties in the absence of naming-speed[1] difficulties
- those with naming-speed difficulties in the absence of phonological difficulties
- those who have both naming speed and phonological difficulties, or double deficits.

Naming speed tasks, such as the rapid naming of known symbols such as letter, digits and objects are considered as one of the best predictors of reading fluency across all languages (Georgiou, Parrila & Liao, 2008; Kirby, Georgiou, Martinussen, Parrila, Bowers, and Llanderl, 2010 Norton & Wolf, 2012). According to their hypothesis, this latter double deficit subgroup should demonstrate more severe reading difficulties than the other two subgroups beause of the compounding effect of deficits in both naming speed and phonological skills.

One of the aims of the study was to explore the profiles of the sample having been grouped according to the double deficit hypothesis. To achieve this, a battery of tests was administered to the sample of children in the study. These included reading and cognitive assessments. The list of tests is provided in Table 1 below.

Table 1: List of Tests used in the Study

Gray Oral Reading Test (4th edition) (GORT-4) (Weiderholt & Bryant, 2001)
Wordchains Word Reading Test (Guron, 1999)
The Nonword Reading Test (Crumpler & McCarty, 2004)
The British Picture Vocabulary Test (3rd edition) (Dunn and Dunn, 2009)
Test of Reception of Grammar (TROG) (2nd edition) (Bishop, 2003)
Rapid automatised naming and rapid alternating stimulus tests (RAN/RAS) (Wolf & Denckla, 2005)
Comprehensive Trail-Making Test (Reynolds, 2002)

1. Naming-speed involves the rapid verbal retrieval of visually presented, known symbols. It is typically assessed using the rapid automatized naming (RAN) test which requires children to name a series of 50 familiar items such as letters, numbers, digits, or colours, as quickly as they can (Denckla & Rudel, 1976; Wolf & Denckla, 2005).

Two language measures were included to provide further information on the profile of strengths and weaknesses of the sample; the British Picture Vocabulary Scale (BPVS) (Dunn & Dunn, 2009) which measures receptive vocabulary, and the Test of Reception of Grammar (TROG) (2nd ed.) (Bishop, 2003), which measures receptive grammar and syntactic awareness.

FINDINGS

Some of the findings relating to the language skills of the struggling readers (n = 72) and the average achieving readers (n = 22) in the study are reported below.

Vocabulary and Grammar Processes in Children with Reading Difficulties

Two independent-samples t-tests were conducted to explore the difference in mean scores on vocabulary and grammar achievement between the struggling readers and skilled readers. The first set of results revealed that the group of average readers achieved significantly higher on vocabulary (as measured by the BPVS standard score) (M = 103.2, SD = 14.8) than the struggling readers (M = 84.5, SD = 8.7; $t(92) = -5.70$, $p < .001$). Similarly, the second t-test revealed that average-achieving readers had significantly higher scores on grammar and syntactic awareness (as measured by the TROG percentile rank) (M =54.1, SD = 11.2) than the struggling readers (M = 29.08, SD = 10.2; $t(92) = -5.05$, $p < .001$). It should be noted that although the significant lower achievement of the children with reading difficulties in language skills may be the result of weak language development, as evidenced in studies of children at risk for dyslexia (e.g., Lyytinen et al., 2004; Muter & Snowling, 2009), it may also be compounded by Matthew effects, a destructive cycle whereby avid readers develop broader and richer vocabularies, while struggling readers fall further behind, creating a cycle of disadvantage. Either way, it is well-established that children who struggle with reading, read less as they grow older and thus do not have the opportunities to consolidate and broaden their vocabulary and language skills through the reading process in the same way as skilled readers do (Cain & Oakhill, 2011; Stanovich, 1986). However, the significant lower achievement in language skills may also be attributed to school factors such as literacy instruction (Eivers, Close, Shiel, Millar, Clerkin, Gileece et al. 2010). In many schools, for instance, there may be an overemphasis on teaching basic and code-related reading skills (e.g., phonics) and an insufficient focus on other important unconstrained skills such as reading comprehension and vocabulary development that are just as important (Eivers et al., 2009; Paris, 2005; Snowling & Hulme, 2011).

As part of the present study, the sample of struggling readers was divided into the double deficit hypothesis subgroups as described above (see Table 1) (e.g., a naming speed deficit subgroup, a phonological deficit subgroup, and a double-deficit subgroup. This resulted in a further subgroup of children emerging who did *not* fit the double deficit hypothesis framework, having neither phonological nor naming speed difficulties and who were, as such, a nonclassified group. The subgroup sizes were small, especially the phonological subgroup (n = 9) and the double deficit subgroups *(*n = 11). However, many studies of the double deficit hypothesis have consisted of subgroup sizes of less than 10 (Ackerman, Holloway, & Youngdahl, 2001; Araújo, Faísca, & Reis, 2011; Escribano, 2007; Jiminez, Hernandez-Valle, Rodriguez, Guzman, Diaz, and Ortiz, 2008; Vukovic, Wilson, & Nash, 2004), and it is acknowledged that there is a need for larger sample sizes in the examination of the double deficit hypothesis (Vukovic & Siegel, 2006). The small numbers in the phonological deficit subgroup may be due to the fact that from the early years in primary school in Ireland there is a focus on the development of phonological skills in the remediation of reading difficulties with the use of structured programmes such as Jolly Phonics (Lloyd & Wernham, 1992).

Table 2: Subgroups that Emerged from the DDH Grouping Procedure

Subgroup	Naming Speed Deficit (n=24)	Phonological Deficit (n=9)	Double Deficit (n=11)	Non Classified *(*n=28)

Note: NS = Naming Speed deficit; PD = Phonological deficit; DD = Double Deficit; NC = nonclassifiable subgroup

A further set of statistical analyses was undertaken to compare these subgroups on language skills. A Kruskal-Wallis nonparametric Test was conducted to compare the resulting four subgroups on vocabulary and grammar median (*Mdn*) scores. It was revealed that there were no significant differences between the subgroups on vocabulary and grammar skills. However, a Mann Whitney U test (a nonparametric statistical test which allows comparisons between two independent groups) comparing the vocabulary ability of the average reader group with the non-classified subgroup revealed that the vocabulary score of the non-classified subgroup was significantly lower (*Mdn* = 83.00) than the AR group (*Mdn* = 98.50, U = 75.00, Z = -3.9, $p < .001$), as was their grammar percentile rank (*Mdn* = 18.54) when compared to the average readers (*Mdn* = 34.3, U = 113.00, Z = -3.9, $p < .01$). The non-classified subgroup demonstrated particular difficulties with language skills rather than phonological skills (which were in the average range) and naming speed (which was also in the average range). In addition, the double-deficit subgroup also achieved a significantly lower vocabulary score (*Mdn* =

6.6) than the average readers (*Mdn* = 21.18, U = 6.5, Z = -4.28, p < .001), and a significantly lower percentile rank for grammar (*Mdn* = 19.95) compared with the average readers (*Mdn* = 21.18, U = 31.00, Z = -3.41, $p < .01$). Importantly, the double deficit subgroup achieved the lowest scores of the four subgroups on both vocabulary (*M* = 78.9, *SD* = 7.0) and grammar (*M* = 27, *SD* = 11.5). In fact children in the double deficit subgroup were weaker than the other three subgroups on all reading subtests on the Gray Oral Reading Test (GORT-4) (reading accuracy, rate, fluency and comprehension). These results are consistent with previous studies indicating that children with double deficits have the most severe reading difficulties of the double deficit hypothesis subgroups (Bexkens, van den Wildenberg & Tijms, 2015; Cronin, 2011; Papadopoulos, Georgiou & Kendeou, 2009).

Interestingly, in the present study, the vocabulary measure correlated significantly with the GORT-4 comprehension subtest measure ($r = .33$) for the sample of children with reading difficulties. The sample as a whole showed well below average ability on reading comprehension with the mean standard score at 80.0 (*SD* = 10.0). A simple regression analysis was computed to examine vocabulary as a predictor of reading comprehension and it was revealed that vocabulary contributed significant unique variance to reading comprehension (r^2 change= .11, $p < .005$) for the sample of struggling readers. This result is consistent with findings that vocabulary has a significant effect on reading comprehension (Cain, 2010; Kucan, 2012; Ouellette & Beers, 2010). However, the TROG grammar variable did not show a significant relationship with any of the reading subtests. This may be because the test is old, the second edition used in this study was normed in 2003. Additionally, a more sensitive measure of syntactic and grammar ability may have been needed to reflect individual differences between groups for this older sample of readers (Nation, 2005).

IMPLICATIONS

Reading is a multi-faceted construct the ultimate goal of which is comprehension (Cain & Oakhill, 2011). Comprehension depends on strong meaning-related skills (Lesaux & Harris, 2013) particularly vocabulary (Biemiller, 2011; Kirby et al., 2008; Lesaux & Harris, 2013). Many children with reading difficulties show poor language skills at an early age. In the present study, older children with dyslexia showed poor vocabulary and grammar skills which were significantly related to reading comprehension. It was beyond the scope of the study to ascertain whether the language difficulties were related to Matthew effects or as a result of more

perverse underlying language difficulties. However, it is imperative that childrens' language skills such as vocabulary and grammar/syntax are assessed along with reading skills as early as possible, in order that early intervention and appropriate support is provided *before* Matthew effects take hold (Cain & Oakhill, 2011; Reynor, 2014).

The children with dyslexia in this study demonstrated significant difficulties with receptive vocabulary and grammar/syntactic awareness skills. These children were nearing the end of their primary school years, and yet many demonstrated well below average language skills, particularly the non-classified and the double-deficit subgroups. Importantly the non-classified subgroup did not show phonological or decoding difficulties, yet they had persistent difficulties with fluent reading and comprehension, probably compounded by their weak language skills. It is also possible that their phonological skills had been targeted and remediated to a large degree with the aid of popular phonological programmes available in all schools. However, it should be noted that phonological processes are discrete or 'constrained' skills (Paris, 2005, p. 189) and as such they are highly amenable to instruction and therefore may be more easily targeted and remediated by teachers (Eivers et al., 2010; Paris, 2005). In contrast, language skills are not mastery-orientated, they continue to develop more slowly over time, which is one of the reasons why grammar and vocabulary are difficult to teach and remediate (Paris, 2005; Snow & Uccelli, 2009).

RECOMMENDATIONS

Language and comprehension are inextricably linked with children's growth as readers because they are meaning-related skills (Kucan, 2012). A growing body of research, including the present study, suggests that struggling readers have difficulties with both reading comprehension and language skills. Both of these aspects of reading development need to be targeted specifically in the early years of primary school (Biemiller, 2011; Cain, 2010). Pupils need opportunities to develop rich vocabulary through oral language, reading, and writing instruction (Kucan, 2012). Language processes such as vocabulary should be an integral component of daily literacy sessions (Biemiller, 2011; Cain et al., 2015). Additionally, ongoing professional development for all teachers, focusing on the importance of these skills and the provision of proven instructional strategies to enhance and support language and meaning–based processes for children with reading difficulties is essential.

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