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The role of low-level first language skills in second language reading, reading-while-listening and listening performance: A study of young dyslexic and non-dyslexic language learners

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Abstract

Our study investigated the differences between low-level L1 skills, L2 reading and listening and reading-while-listening outcomes of young dyslexic and non-dyslexic Slovenian learners of English. The research, in which children completed four language assessment tasks in three modes in a carefully counter-balanced order, also examined the relationship between low-level L1 skills and L2 reading, listening and reading-while-listening performance. The findings show that, in Slovenian, which is a transparent language, dyslexic students are behind their non-dyslexic peers in word-level L1 skills after five years of literacy instruction. The results also call attention to the fact that students with weak L2 reading and listening skills might not always be at risk of, or diagnosed as having, dyslexia. Importantly, the findings suggest that the accuracy and speed of real and non-word reading in L1 might serve as useful indicators of L2 reading difficulties of young language learners. Furthermore, L1 dictation tests were also found to yield diagnostic information on young L2 learners' listening and reading-while listening problems.

Introduction

The cognitive factors that influence processes of second language (L2) development have been widely researched but, until recently, the language learning processes of students with Specific Learning Difficulties (SLDs) had received little attention (for an overview see Kormos, 2017). SLDs do not only influence the development of oral and literacy skills in children's first language (L1), they also have a potential impact on the processes of L2 learning. Among SLDs, one of the most frequent types of learning difficulties is dyslexia. According to the 5th Edition of the Diagnostic and Statistic Manual of Mental Disorders of the American Psychiatric Association (DSM-5, APA, 2013), dyslexia manifests itself in word-level decoding difficulties, which can also result in global text comprehension difficulties. Dyslexic individuals are characterized by underlying weaknesses in the areas of working memory, executive functioning (planning, organizing, strategizing and paying attention), processing speed, phonological and orthographic processing (DSM-5, APA, 2013). In order to gain a better understanding of how dyslexic children acquire an additional language and identify students who are at risk of L2 learning difficulties, there is a growing need for research that includes dyslexic students and that investigates how low-level L1 language skills such as phonological awareness, word-decoding and orthographic skills, which are often used as predictors of dyslexia, may affect second language comprehension.

Although cognitive determinants of L2 reading performance have been investigated by many studies (for a review see Alderson, Haapakangas, Huhta, Nieminen, and Ullakonoja 2015), research on how cognitive abilities and language skills in the L1 influence L2 listening and reading-while-listening performance is scarce. While the role of working memory capacity has been thoroughly examined, little is known about how low-level L1 skills predict L2 reading, reading-while-listening and listening performance in the early stages of instructed second language learning. With the extended use of technological devices that allow for multi-modal language processing, such as listening to a text while simultaneously reading it, it is also necessary to examine an extended range of language comprehension processes. An understanding of the role of low-level L1 skills in instructed L2 language learning contexts is also important because it can help us to predict whether young language learners who have L1 literacy-related difficulties in early primary education will face challenges in acquiring another language.

In light of the aforementioned issues, in our research we investigate the differences between low-level L1 skills, L2 reading, reading-while-listening and listening outcomes of young dyslexic and non-dyslexic learners and the link between low-level L1 skills and L2 reading, reading-while-listening and listening performance. The study was conducted with young Slovenian learners of English who completed four language assessment tasks in three modes in a carefully counter-balanced order. The results gained in the Slovenian context for language learning, where children receive English language instruction in the classroom and are exposed to the language outside school primarily through electronic media, are also transferable to many other European contexts.

In this paper, we first give a concise summary of the psycholinguistic processes and cognitive determinants of reading, reading-while-listening and listening in L1 and L2. We then review the available findings on the overlaps between L1 literacy-related difficulties and L2 learning problems and the effect of dyslexia on L2 reading and listening. Next, we present the design and results of our research. This is followed by a discussion of the findings and their implications for the identification of L2 learning difficulties.

Review of literature

Psycholinguistic processing during reading, reading-while-listening and listening

As our research investigates predictors of L2 performance in three modalities: reading, reading-while-listening and listening, it is important to briefly outline the most important psychological processing mechanisms underlying reading and listening comprehension. We base this review on Tunmer and Chapman’s (2012) Modified Simple View of Reading, because this model allows us to highlight the overlapping processes of comprehending spoken and written texts. Tunmer and Chapman (2012) argue that general language comprehension skills and accurate and fluent written word recognition in a joint interaction with each other contribute to successful reading comprehension. This interdependent relationship between language comprehension and word decoding is mediated by oral vocabulary knowledge and the richness of lexical representations (Perfetti, 2007). This assumption is made because a large vocabulary size and depth can facilitate both efficient word recognition and text-level comprehension. Language comprehension skills above the word level include syntactic analysis, the creation of a text model, i.e. processing the informational content of a text, and the establishment of a situation model which is used for the interpretation of information based on background knowledge (Kintsch, 1998). Readers and listeners also need to understand the structure of a text, make inferences and monitor comprehension (Kintsch, 1998). L2 reading processes are very similar to those in L1 reading but lexical representations in L2 are often less well developed, and lower-level reading processes are less automatic in L2 than in L1 (Melby-Lervåg & Lervåg, 2014).

The most important psycholinguistic processing difference between reading and listening is related to word-level decoding, which in reading takes place through visual, and in listening through auditory, channels. Written word decoding starts with orthographic processing, in other words the recognition of letters, and continues with phonological processing through which readers convert letters into sounds, blend them to form words and activate phonological forms of words. Word decoding also involves the retrieval of semantic and syntactic information related to a word and morphological processing which helps readers understand words with prefixes and suffixes (for a review see Hoover & Gough, 1990). When comprehending spoken language, listeners have to distinguish speech from noise, identify boundaries of relevant linguistic units in the stream of speech, process units of sounds and retrieve words from the mental lexicon based on their phonological form (Anderson, 1995). From this point, processing mechanisms such as syntactic parsing and discourse level comprehension work in a similar way to reading. It is important to note, however, that recent research shows that once children have been exposed to written language, orthographic information, such as the spelling of words, is often co-activated in spoken word recognition (e.g. Grainger & Ziegler, 2011). This new finding highlights the strong inter-relationship of orthographic and phonological processing skills both in written and spoken language comprehension.

Listening comprehension in an L2 can prove to be challenging for learners because of real-time processing pressures, the interactivity of discourse and the lack of opportunity to review the text if comprehension fails (Lund, 1991). Another source of listening comprehension difficulty might be that L2 learners in classroom contexts often encounter words in written format and might acquire the orthographic information related to words before phonological information. This can result in spoken word recognition problems especially at lower levels of language proficiency (cf. Veivo & Järvikivi, 2013).

The similarities of the underlying psycholinguistic processing mechanisms explain the strong inter-relationship of L1 and L2 listening and reading comprehension (e.g. Joshi, Williams & Wood, 1998; de Jong & van der Leij, 2002; Lund, 1991). In the field of L2 research, however, little is known about how a text simultaneously presented through visual and auditory channels is processed. L1 psycholinguistic research suggests that phonological information facilitates written word recognition (e.g. Sauval, Perre, & Casalis, 2017). Furthermore, when a text is read as well as listened to, it is processed in both visual and auditory working memory, which assists in retaining information and building connections between them (Moreno & Mayer, 2002). This explains findings that have shown that multimodal presentation can enhance the comprehension and recall of information (for a recent review see Wood, Moxley, Tighe & Wagner, 2018). In a previous study, we also investigated the benefit of reading-while-listening for dyslexic and non-dyslexic L2 learners (Košak-Babuder, Kormos, Ratajczak and Pižorn, forthcoming). In line with earlier results obtained by Chang (2009), our findings indicated that young EFL learners scored higher when they received multi-modal input than when they listened to a text only.

Individual differences in L2 reading and listening performance

Perfetti, Zhang and Berent (1992) in their *Universal Phonological Principle* argue that phonological decoding processes play a key role in reading in any language, regardless of its orthographic system. Therefore, individual variations in abilities relating to phonological decoding significantly contribute to the rate and ultimate attainment of reading development. Furthermore, Geva and Ryan (1993) in their *common underlying processes framework* also state that a key set of individual difference variables predict reading development in both monolingual and bilingual children. These models of reading show that cognitive individual differences that account for differential success in L1 literacy and L2 reading outcomes are very similar. Phonological awareness, i.e. the ability to recognize, identify and manipulate phonological units of various size such as syllables, onset, rhymes and phonemes, is one of the most important of these individual differences (Ziegler & Goswami, 2005).

Phonological awareness, however, develops as children acquire literacy skills and it becomes a less reliable indicator of reading outcomes (Landerl et al., 2013). Its predictive role is taken over by word naming speed (for a review see Kirby, Georgiou, Martinussen & Parrila, 2010), which is a measure of an individual's ability to access appropriate lexical representations under time constraints. In the field of L2 reading, Erdos, Genesee, Savage and Haigh's (2014) research, in a Canadian immersion context, showed that tests of both phonological awareness and rapid automated naming in L1 were successful in predicting word- and text-level reading comprehension problems of children in L2 French.

In the initial stages of learning to read, efficient word-level decoding is a key component of understanding sentences and longer texts and children show considerable variation in this low-level reading skill (Gough & Tunmer, 1986; Tunmer & Chapman, 2012).

Another important predictor of word-level reading is orthographic processing skills, which is the ability to establish, store and access orthographic representations (Stanovich & West, 1989), and which is often assessed by dictation tests. Orthographic processing skills assist children in developing their orthographic lexicon (Perfetti, 1992), which contains "orthographic units of various types, i.e., recurring letter combinations, morphemes and whole words, and becomes an integral part of the lexical system recruited during word recognition" (Rakhlin, Cardoso-Martins & Grigorenko, 2014, p. 396). Orthographic processing skills have been shown to be significant contributors to word and text level reading in L1 (e.g. Barker, Torgesen & Wagner, 1992). L1 orthographic skills have been found to play an important role in L2 word reading in a French immersion context (Deacon, Wade-Wooley & Kirby, 2009) and in Spanish-English bilingual children (Deacon, Cheng, Luo and Ramirez, 2013).

Research conducted with bilingual children has consistently shown the important contribution of tests of word-level decoding, such as timed and non-timed word reading, to the assessment of L2 reading outcomes (e.g. Geva, 2000). In these contexts, however, word-level decoding tests are generally administered in the children's L2 (for a review see Kormos, 2017). One of the few exceptions is Alderson et al.'s (2015) study in which children completed cognitive tests and word-reading tasks in both L1 and L2. The results showed that timed word-reading in both L1 and L2 was a good predictor of reading attainment in L2 in Grade 4. Van Gelderen, Schoonen, De Glopper, Hulstijn, Simis, Snellings, and Stevenson (2004) also found that timed word-reading in L2 was linked to L2 reading performance, but its role became non-significant when L2 vocabulary knowledge was also included as a predictor variable. Previous findings suggest that even in the case of children who have had limited exposure to the target language, cognitive tests administered in the L2 can be informative (e.g. Bourgoin, 2014; Pižorn &Erbeli, 2013). However, a combination of L1 and L2 assessment tools is needed in order to carry out a detailed diagnostic analysis of the cognitive factors underlying L2 reading performance.

In addition to phonological awareness, orthographic processing skills, the efficiency of lexical access and word-level decoding skills, another important cognitive ability that can influence reading comprehension in both L1 and L2 is working memory capacity (Gathercole & Baddeley, 1993). Many of the studies reviewed in Linck, Osthus, Koeth and Bunting's (2014) meta-analysis indicate that individual differences in working memory strongly influence L1 and L2 reading skills. Further cognitive differences in processing speed, attention control and the ability to infer meaning also explain variations in efficient word reading and the functioning of higher order text comprehension processes (for a review see Kormos, 2017).

As regards listening comprehension, research findings suggest that among young children, successful understanding of oral texts in L1 depends on working memory (e.g. Daneman & Merikle, 1996) and verbal reasoning abilities (e.g. Florit, Roch & Levorato, 2011). In a recent study, Tighe, Spences and Schatschneider (2015) also showed that at Grade 3, real word-, non-word and text-reading fluency plays an important role in L1 spoken language comprehension, but its role diminishes by Grades 7 and 10. Interestingly, their results indicated limited effects of working memory abilities across all grade levels. Research by Andringa, Olsthoorn, van Beuningen, Schoonen and Hulstijn (2012), which investigated predictors of L1 and L2 listening performance showed that the efficiency and speed of processing linguistic information are more substantial contributors to L1 and L2 oral language comprehension than working memory capacity.

Another potential and somewhat surprising predictor of spoken language comprehension is orthographic processing skill. Research by Perre, Pattamadilok, Montant and Ziegler, (2009) demonstrates that literate participants rely on both phonological and orthographic information when decoding spoken words. Their findings suggest that as a result of literacy instruction the phonological representation of words is enriched with orthographic information and the phonological and orthographic information is jointly activated in spoken language processing. In a recent study Veivo and Järvikivi (2013) also found that L1 orthographic information assisted in L2 spoken word recognition among high proficiency L2 learners but did not have a facilitating effect in the low proficiency group.

To our knowledge, the only study that has examined the role of individual differences in reading-while listening in L2 was carried out by Kozan, Erçetin and Richardson (2015). In their research, participants with high working memory capacity retained more information in a delayed post-test in audio-visual presentation mode than low-working memory participants. Based on van Heuven and Dijkstra's (2010) bilingual interactive activation model of word recognition, we can assume, however, that orthographic skills might also play an important role in bi-modal language comprehension. In this model, phonological and orthographic information is co-activated in both written and spoken language production, because orthographic, phonological and semantic information is jointly stored and accessed in the bilingual mental lexicon.

Dyslexia and second language learning

As can be seen in the above overview, there are large overlaps among the basic cognitive factors and low-level language skills that account for variations in L1 literacy outcomes and L2 language success. Similar to Geva and Ryan's (1993) common underlying processes framework, Sparks and Ganschow's (1993) Linguistic Coding Differences Hypothesis posits that the fundamental cognitive reasons for low achievement in L2 are analogous to those that explain literacy-related difficulties in L1. Nevertheless, there is mixed evidence regarding the question of whether struggling L2 learners also experience problems in their L1, and whether L1 literacy-related problems always manifest themselves in L2 learning challenges. For example, Alderson et al. (2015) found that 15 per cent of weak readers in L2 English belonged to the group of strong readers in their L1 Finnish in Grade 4 (aged 11). Ferrari and Palladino's (2007) research with Italian children also indicated that L1 reading skills might not fully account for L2 learning outcomes. In the first phase of their study, low- and high-achieving English language learners did not differ significantly in L1 reading speed and accuracy, and students at risk of L2 learning difficulties did not meet the diagnostic criteria for dyslexic-type reading difficulties in their L1.

Research findings, however, consistently show that dyslexic-type difficulties tend to have a negative impact on L2 reading comprehension. Both Norwegian (Helland & Kaasa, 2005) and Hungarian children with an official diagnosis of dyslexia (Kormos & Mikó, 2010) were found to score lower on a test of L2 English word reading than their non-dyslexic peers. Hungarian children with SLDs also achieved lower scores on a sentence comprehension test than their peers matched for age and the number of years of English language instruction (Kormos & Mikó, 2010). Similar findings were obtained by Geva, Wade-Woolley and Shany (1993) in Canada, Crombie (1997) in Scotland and by Sparks and Ganschow (2001) in a study of dyslexic learners of Spanish as a foreign language in the United States.

Findings concerning the difficulties of dyslexic language learners with listening comprehension have been mixed. In the Canadian ESL context, Geva and Massey-Garrison (2013) found that L2-speaking children with word-level decoding problems and specific reading comprehension difficulties demonstrated poorer listening performance than typically developing children. Crombie's (1997) research also found significant differences in the listening outcomes of dyslexic and non-dyslexic Scottish schoolchildren learning French. Non-significant differences between dyslexic and non-dyslexic students were seen in Norway and Hungary in a test of L2 sentence-level listening comprehension (Helland & Kaasa, 2005; Kormos & Mikó, 2010).

As the above review of literature highlights, there is a scarcity of studies on how low-level L1 language skills, such as phonological awareness and L1 word-decoding efficiency, which are key early predictors of L1 literacy difficulties, relate to the reading, reading-while-listening and listening performance in L2. Our study is unique in examining the role of these low- level L1 skills in multi-modal language comprehension and contributes new knowledge to understanding the potential causes of comprehension difficulties of young L2 learners in instructed classroom contexts. In our study, which was conducted in the context of learning English as a foreign language in Slovenia, we asked three research questions, the first of which served as means of verifying the dyslexia identification of our participants. The remaining two questions served as the main questions of the study.

1. How do the low-level L1 skills of young dyslexic and non-dyslexic Slovenian learners differ?
2. How do the L2 reading, reading-while-listening and listening performance of young dyslexic and non-dyslexic Slovenian learners differ?
3. How do low-level L1 skills and dyslexia status predict L2 reading, reading-while-listening and listening performance of young Slovenian learners?

Method

Forty-seven students with an official diagnosis of dyslexia and 233 students with no certified learning difficulties participated in this study (N=280; 165 males and 115 females). They were all young learners of English in Slovenia and they all attended Year 6 of primary school. Their ages ranged between 11.10 and 12.80 years. The compulsory age for starting to learn English was Year 4 (age 9) for these students, but approximately 75 per cent of the participants received some English language instruction before Year 4 as well. The students' level of proficiency according to the Common European Framework of Reference (Council of Europe, 2001) can be estimated as being around A2, based on the Slovenian National English test annually administered to this age group.

Forty-seven participants had an official certificate that stated a diagnosis of dyslexia. In Slovenia, dyslexia is assessed by a small team consisting of a trained psychologist and a special education teacher. A detailed assessment involves the administration of a battery of cognitive tests (e.g. phonological awareness, rapid automated word naming, reading, spelling, working memory tests and tests of intelligence). This is complemented with information gained from interviews with the children and their parents, the administration of questionnaires, literacy skills tests, observations of the children's performance in class and analyses of work samples. The majority of the participants in our study underwent dyslexia assessment between the ages of 8 and 9.

Instruments

For the assessment of students' reading, reading-while-listening and listening skills we chose four tasks from a test bank of Slovenian National English Tests for Year 6 students. This standardized assessment tool, designed by a team of local testing experts, is administered to children each year and yields information about the English language proficiency of the target population. We selected four informational texts from the test battery which had Flesh-Kincaid Reading Ease values (Kincaid, Fishburne, Rogers, R. L., Chissom, 1975) of between 3.3 and 4.5 and acceptable reliability indices in the respective years when they were administered (for more information on test reliability see Appendix 1). The topics of the texts were of general interest to children (e.g. pirates, camping, cooking, school). A North American native speaker of English was asked to read out the texts at a slow conversational speech rate (between 96.5 and 120.4 words/minute). These recordings were used in the listening and reading-while-listening tasks. Participants read two texts, listened to one text and read one text while listening to the recorded version of the text. Two reading texts were used for having a solid basis of comparison in this mode of performance and to fill the class-time that was available for conducting our study. Comprehension of the texts was checked by six questions which required short answers ranging from one to six words. Given that the texts were informational and the students were at A2 level proficiency, the comprehension questions assessed the understanding of local information, rather than global text comprehension or the understanding of implicit meaning.

In order to assess low-level L1 skills, four sub-tests from the Slovenian version of the Special Needs Assessment Profile (SNAP) (Weedon & Reid, 2008) were used. The children completed the four tasks in their first language, Slovenian. A timed reading task, which measured the number of correctly read single words in 30 seconds, aimed to assess word-decoding and word recognition abilities. This test is divided into four sections. Each section contains seven individual words and three sentences (altogether 156 words). The words and sentences increase in complexity from one section to the next. A non-word reading task, in which the number of correctly read non-words in a minute was counted, gave diagnostic information about word-level phonological decoding skills. This test consisted of 40 non-words which increased in complexity and length. In a test of phonological awareness, participants were asked to delete specific phonemes in spoken non-words. The test included ten trials. A timed dictation task tested how many words students could write down correctly in two minutes' time. This test yielded insights into students' orthographic processing skills as well as their knowledge of phonological and orthographic forms of words, and through this their depth of lexical representation (Perfetti, 2007). The students listened to a sentence which included the word they had to spell. The target word was repeated and the participants were asked to write down the word they heard. The maximum number of items in this test was 24.

Procedures

The Ethics Committee of the Faculty of Education, University of Ljubljana approved the research. Prior to data collection, the participating students and their parents were informed about the aims and procedures of the study and asked for their consent.

The English language tests, which took 30–40 minutes, were group administered during class hours. Students could listen to the text only once in the listening and reading-while listening modes. Trained research assistants supervised the administration of the tests. The students received instructions on how to complete the tasks in Slovenian. We carefully counter-balanced the order of the tasks and the mode in which they were performed (see Table 1). Half of the participant groups read Texts A and B, and another half C and D. There were always two groups which only listened to or read-while listening to a given text. The two groups that listened to or read a particular text while listening differed in the order in which they performed the task. Although this arrangement did not cover all the possible combinations in a Latin-square design, it offered a good compromise given our access to participants. The group sizes were not always equal either because we conducted the research in intact classes. As the sample size was large, this was not assumed to present a problem for data analysis. This counter-balanced design ensured that the sequence in which the students completed the tasks did not influence the findings (for a detailed analysis of the impact of mode and text difficulty on performance see Košak-Babuder et al., forthcoming).

The four tests assessing low-level L1skills were administered individually by a trained research assistant in a quiet room. It took 15 minutes for children to complete these four tests.

Insert Table 1 around here

Analysis

Two trained research assistants marked the English language tests on a standardized answer sheet for the Slovenian national language exam. Only answers listed on the answer sheet were accepted. The research assistants also scored the four low-level L1 skills test by following the instructions in the administration manual for the SNAP test. The second author of the paper supervised the scoring of the English language test and the third author oversaw the marking of the SNAP test components. SPSS Version 22 was used for data analysis. The statistical procedures included computing descriptive statistics, the use of multivariate analysis of variance (MANOVA) and Chi-square analyses for investigating differences between dyslexic and non-dyslexic students. We also conducted multiple regression analyses to establish the role of low-level L1 skills and dyslexia status in reading, reading-while-listening and listening performance. The effect size measure in the MANOVA analysis was the multi-variate eta squared value. Based on Cohen (1992), effect sizes below 0.06 were considered small, between 0.06 and 0.14 medium, and above .14 large. Following Cohen (1988) correlation coefficients between .10 and .29 were evaluated as small, between .30 and .49 as moderate and above .50 as large.

Results

Differences in the low-level L1 skills of young dyslexic and non-dyslexic learners

Our first preliminary research question aimed to investigate differences in low-level L1 skills between young Slovenian learners who held an official dyslexia certificate and their peers with no apparent learning difficulties. In order to answer this question, we first assessed whether the four L1 tests were normally distributed. We applied the rule of thumb of dividing skewness and kurtosis with their respective standard errors. All variables except for phonological awareness met the criteria for normal distribution as the values fell between the +/-1.96 limits (Field, 2009). The phonological awareness test, however was highly negatively skewed and showed a restricted range of distribution (see Supplementary materials for descriptive statistics). Although the mean value on this test was relatively close to the maximum score of the sample, 33 per cent of the students scored below the mean, indicating that there was no clear ceiling effect.

As a next step, we checked multi-variate normality by computing Mahalanobis distances (Tabachnik & Fidell, 2007). The analysis showed that the maximum Mahalanobis distance in our sample (Mah. Dist = 32.14) was well above the critical value of 18.47 established for four variables (Tabachnik & Fidell, 2007). Four dyslexic students were found to be multivariate outliers because they had a standardized residual lower than -3.3. After they were removed from the data set, the Mahalanobis distance figure (Mah. Dist = 16.01) no longer exceeded the critical value. We also examined the inter-correlations between low-level L1 skills. They were all significantly correlated, but the strength of the relationship was strong only in the case of timed reading and non-word reading tasks, and even this value was below the recommended .8 value (Tabachnik & Fidell, 2007). The other correlations fell within the moderate range (see Table 2).

Finally, we examined the differences in low-level L1 skills between officially diagnosed dyslexic and non-dyslexic students with the help of the MANOVA procedure. The

MANOVA analysis showed an overall large effect of dyslexia status on L1 linguistic measures, *F* (4, 271) = 28.93, *p* < .001; Wilks' Lambda = .74; partial eta squared = .256. Post hoc ANOVA tests indicated that the dyslexic students scored significantly lower on all tests, but the effect size of the difference between the groups was large only for the dictation task score: *F* (1, 271) = 74.32, *p* < .001; partial eta squared = .213. The effect size of the difference for the timed reading score, *F* (1, 271) = 36.91, *p* < .001; partial eta squared = .119, phonological awareness *F* (1, 271) = 21.51, *p* < .001; partial eta squared = .073 and non-word reading tasks, *F* (1, 271) = 29.45, *p* < .001; partial eta squared = .097, was medium (see Table 3).

Insert Tables 2 and 3 around here

Relationship between official dyslexia status and L2 reading, reading-while-listening and listening performance

In order to answer our second research question, which enquired into the differences between students with an official certificate of dyslexia diagnosis and their peers in L2 reading, reading-while-listening and listening performance we first applied the MANOVA procedure. Before the analysis, we ascertained that there were no multivariate outliers in terms of L2 reading, reading-while-listening and listening scores. The Mahalanobis distance value (Mah. Dist = 15.591) did not exceed the critical value for the three dependent variables (16.27). We also checked multi-collinearity and found that although all the scores correlated significantly, the strength of relationship was below.8.

The MANOVA analysis showed a moderate effect of dyslexia status on reading, reading-while-listening and listening scores, *F* (3, 272) = 12.51, *p* < .001; Wilks' Lambda =

.879; partial eta squared = .121. Post hoc ANOVA tests revealed that the dyslexic students performed significantly below the level of their non-dyslexic peers on all tests. The effect size of the difference between the groups was moderate for reading scores, F (1, 271) = 27.62, $p < .001$; partial eta squared = .092, and listening scores, F (1, 271) = 25.03, $p < .001$; partial eta squared = .084, and weak for reading-while-listening scores, F (1, 271) = 10.11, $p = .002$; partial eta squared = .036 (see Table 3).

As we found only a moderate effect of dyslexia on L2 reading, reading-while-listening and listening performance, we were interested in exploring further what proportions of poor, high and average L2 readers, listeners and reader-listeners held an official certificate of dyslexia. This analysis yields more detailed insights into the exact nature of the overlap between dyslexic-type reading difficulties in the L1 and L2 reading, reading-while-listening and listening difficulties. We transformed reading, reading-while-listening and listening scores into z-scores. Following a similar analysis conducted by Alderson, Nieminen and Huhta (2016), students with a z-score below -1 were classified as poor, and above +1 as strong, readers, listeners and reader-listeners, respectively. Next, we carried out a Chi-square analysis, which compares the observed frequencies with values that would be expected if there was no relationship between the variables of dyslexia identification and reading/reading-while-listening/listening abilities. The standardized residual measure was used to establish if the difference between observed and expected values was statistically significant. The standardized residual is the ratio of the difference between the observed count and the expected count to the standard deviation of the expected count. If the residual is less than -2 or greater than +2, the cell's observed frequency is significantly different from the expected frequency (Gravetter & Walnau, 2004).

The analysis showed that non-dyslexic students also belonged to the poor-reader category (approximately 15 %) and that only somewhat less than half of the dyslexic students fell into the poor reader category (42%). Approximately half of the dyslexic students were ‘average’ L2 readers, but only 5 per cent could be classified as strong readers (see Table 4). The Chi-square analysis showed a statistically significant relationship between dyslexia status and reading classification, χ^2 (2, n= 276) = 20.26, p <.001). A similar result was obtained when students were grouped as poor, average and strong listeners, χ^2 (2, n= 276) = 18.76, p <.001). The standardized residuals revealed that while non-dyslexic students showed a distribution that was not significantly different from the expected values, the dyslexic students were more often classified as poor L2 readers and listeners than expected and less often classified as strong readers. In the reading-while-listening test, no student in the sample scored more than one z-score above average, and there was little difference in the distribution of dyslexic students in the poor and average reading-while-listening groups (see Table 4). The Chi-square analysis revealed no statistically significant link between dyslexia status and read-aloud classification χ^2 (2, n= 276) = 3.13, p = .084).

Insert Table 4 around here

The relationship of low-level L1 skills and L2 reading, reading-while-listening and listening performance

For our third research question, we first examined the relationship between low-level L1 skills and L2 reading, reading-while-listening and listening performance. As can be seen in Table 2, all correlations were significant but they were mostly relatively weak. Moderately strong correlations were observed between timed L1 reading, non-word reading and dictation tasks on the one hand, and L2 reading on the other. Scores on the dictation task were moderately strongly related to performance on all three L2 tests (see Table 2).

We were also interested in how much individual contribution the different low-level L1 measures and dyslexia status make in a joint statistical model. We conducted multiple regression analysis with phonological awareness, timed non-word reading, timed word reading and dictation test scores and dyslexia status as independent variables. Dyslexia status was coded as 0 for non-dyslexic students and 1 for dyslexic students and was included as a dummy variable in the models. The results showed that the predictor variables explained 24.6% of the variance in L2 reading performance F (4, 271) = 17.63, p <.001 (see Table 5). Timed word-reading made the strongest unique contribution to L2 reading (β = .25, p <.001) and non-word reading was also a significant unique predictor (β = .13, p < .001).

Insert Table 5 around here

We repeated the same analysis with the L2 listening test as the dependent variable. In this model the low level L1 predictors and dyslexia status accounted for 14.5% of the variance in L2 listening scores F (4, 271) = 9.18 p <. 001 (see Table 6). The dictation task made the strongest unique contribution (β = .20, p = .003), and dyslexia status (β = -.17, p =.011) and timed reading (β= -.15, p =.040) were also significant unique predictors. In the regression model of reading-while-listening test the only unique predictor was the dictation task (β= .24, p = .001) F (4, 271) = 6.86, p < .001 (see Table 7). The predictor variables in the model accounted only for 11.3% of the variance.

Insert Tables 6 and 7 around here

Discussion

The low-level L1 skills of young dyslexic and non-dyslexic learners

For our first research question, we investigated the differences in low-level L1 skills between young language learners who hold an official certificate of dyslexia and those who do not seem to exhibit any learning difficulties. The MANOVA analysis showed that there is a large overall effect of dyslexia on these low-level L1 skills even in Year 6 of primary school. This finding might yield additional support for the validity of the official diagnoses of dyslexia of the participants, which is a learning difficulty manifesting itself in word-level decoding skills (APA, 2013). The results also show that in Slovenian, which is a transparent language, dyslexic students are still behind their non-dyslexic peers in word-level L1 skills after five years of literacy instruction.

However, if we examine the effect sizes of the sub-components of low-level L1 skills, we find that differences in phonological awareness between dyslexic and non-dyslexic students were relatively small. As discussed in the review of literature, phonological processing is assumed to play a key role in reading in any language (Perfetti et al.,1992). Yet this role changes as children receive literacy instruction and develop their word-level decoding skills. The relative importance of phonological awareness also varies depending on the transparency of the L1 orthographic system (Landerl et al., 2013). Thus, the findings of our study with regard to the diminished role of phonological awareness as a predictor of word-level reading difficulties in Slovenian seem to be in line with the results of Landerl et al.'s (2013) survey of Finnish, Hungarian, German, Dutch, French and English children of a similar age.

The L2 reading, reading-while-listening and listening skills of young dyslexic and non-dyslexic learners

Our second research question asked about the differences in L2 reading, reading-while-listening and listening performance between dyslexic and non-dyslexic children. Although the ANOVA tests showed that dyslexic students scored significantly lower in these three areas, the effect size for the difference was moderate in the case of reading and listening and small for the reading-while-listening tests. All previous research conducted with dyslexic language learners has consistently shown that their L2 reading performance is below that of their peers (e.g. Crombie, 1997; Helland & Kaasa, 2005; Kormos & Mikó, 2010; Geva, Wade-Woolley & Shany; Sparks & Ganschow, 2001). This can be explained by the transfer of literacy-related difficulties in L1 to the L2 and by the underlying common cognitive determinants of reading abilities in L1 and L2 (Geva & Ryan, 1993; Sparks & Ganschow, 1993).

Our findings also show that L2 learners with an official diagnosis of dyslexia performed below the level of their peers in terms of L2 listening comprehension. This finding is similar to those of Geva and Massey-Garrison (2013) and Crombie (1997), but different from those previously obtained by Helland and Kaasa (2005) and Kormos and Mikó (2010), who detected no significant difference between dyslexic and non-dyslexic children's L2 listening performance. The reason for the different findings might be that Helland and Kaasa (2005) and Kormos and Mikó (2010), who used the same instrument, only assessed sentence-level comprehension while Geva and Massey-Garrison as well as our study used texts consisting of short paragraphs. Students could only listen to the texts once and dyslexic students might not have understood and recalled as much information as their non-dyslexic peers because they tend to be characterized by smaller working memory capacity and slower speed of language processing (Lovett et al., 2000)

Although dyslexic and non-dyslexic students differed significantly on the reading-while-listening task, the effect size of the difference was small. As discussed in the review of literature, the opportunity to listen to a text decreases the demands on written word-level decoding resources, which might assist dyslexic students in the successful comprehension of the text.

In our analyses, we were also interested in examining the proportion of dyslexic students among those who were poor L2 readers and listeners. This phase of our analysis complements the previous findings, which showed moderate effects of dyslexia status on L2 reading and listening performance. With regard to L2 reading, the results suggest that nearly half of dyslexic students were poor L2 readers and most of them fell into the average reader category. Among the non-dyslexic students approximately 16 per cent were poor readers and 20 per cent poor listeners. The distribution of dyslexic students in the poor, average and strong L2 listener categories showed a similar pattern. The results also highlight that approximately half of the dyslexic students can achieve L2 average reading skills and one third of the students acquire L2 listening skills which match the average levels of their peers. Attaining outstanding L2 reading and listening scores, however, can be challenging for the investigated group of young dyslexic learners.

The role of low-level L1 skills in L2 reading, reading-while-listening and listening performance

In our study, we also examined what role low-level L1 skills play in L2 reading, reading-while-listening and listening performance. With regard to L2 reading outcomes, our research shows that timed non-word and real-word reading make significant and unique contributions to L2 reading scores, and jointly these L1 measures explain about a quarter of the variance in performance. This result reveals that L1 word-decoding measures play a potentially important role in L2 reading in the investigated group of Slovenian children.

Phonological awareness has been previously found to be a significant contributor to both L1 and L2 reading outcomes (for a review see Geva & Wiener, 2014), but our study only partially confirms these earlier findings. Although the correlational analyses showed that phonological awareness is associated with L2 reading scores, the regression analysis revealed that it does not make a unique contribution when L1 word-reading and orthographic measures are included. As discussed earlier, this might be because with the development of children's literacy skills in both L1 and L2, phonological awareness also increases and reaches a ceiling, beyond which it has limited influence on text comprehension (Landerl et al., 2013). Our regression model (see Table 5) also showed that L1 word-level reading measures, namely timed word and non-word reading, which assess both the speed and accuracy of word-level decoding, make a unique, albeit small, contribution to L2 reading. Another noteworthy finding of the regression analysis is that dyslexia status did not make a unique contribution to variance in L2 reading skills when low level L1 skills were controlled for. On the one hand, this suggests that the L2 reading difficulties of students with an official dyslexia diagnosis are associated with low-level L1 word decoding difficulties. On the other hand, it also indicates that tests of low level skills can yield useful diagnostic information about L2 reading difficulties in cases when dyslexia was not, or for some reason could not be, officially identified. It is also important to note, however, that almost 75 per cent of the variance in L2 reading is explained by factors other than the investigated low level L1 skills and dyslexia status. This suggests that our participants were at a level of literacy development where lower-order L1 skills still explain some variability in L2 reading performance, but the role of higher-order reading processes and L2 knowledge and skills, in particular L2 vocabulary knowledge, might play a more prominent role (see e.g. Alderson et al., 2015, van Gelderen et al., 2004).

The regression model for L2 listening (see Table 6) showed some differences in comparison with that of L2 reading. First of all, low-level L1 skills and dyslexia status explained almost half as much variance in listening (14.5%) as in reading (24.6%). The other noteworthy difference is that among the low-level L1 skills only timed word reading and dictation were significant unique predictors. The dictation task assesses a relatively complex set of skills: orthographic awareness, recognition of the phonological form of words and the conversion of phonological information into an orthographic representation. In order to be able to perform all these processes efficiently under time constraints, children also need to have rich lexical representations (Perfetti, 2007). As we discussed in the review of literature (cf. van Heuven and Dijkstra, 2010), oral and written language comprehension both rely on phonological and orthographic processing, which are abilities that our timed real-word reading and dictation tasks assessed.

Previous research investigating the predictors of listening comprehension has also found that word decoding fluency is a significant predictor of the listening comprehension ability of L1 speaking children in the early stages of their education, but its role diminishes with age (Tighe et al., 2015). In a research project with young children in French immersion, Vandergrift and Baker (2015) found that L1 vocabulary knowledge was an important contributor to L2 listening performance, and in an earlier study by Vandergrift (2006) L1 listening skills accounted for 14 per cent of variance in L2 listening. The scarcity of studies makes it difficult to compare findings, but as we argued earlier, rich lexical representations in L1, which contain both orthographic and phonological information, assist fluent L2 spoken word recognition (see also Veivo & Järvikivi, 2013). This can explain why L1 vocabulary knowledge in Vandergrift and Baker's (2015) study and timed L1 word reading and dictation in our research contributed to success in decoding L2 spoken texts.

Furthermore, the findings of the regression analysis also indicate that dyslexia status makes a significant unique contribution to the variance in L2 listening scores when the effect of low-level L1 skills is controlled for. This suggests that additional difficulties, such as lower working memory capacity, which were not captured by the low-level L1 assessment tools contribute to L2 listening performance.

In the regression model for reading-while-listening, only the dictation task was a significant unique predictor of performance (Table 7). The reason for this finding might be that both reading-while-listening as well as performing a dictation task require students to rely on visual as well as spoken language processing. The shared dual modality of reading while listening and writing down words after having heard them might explain the role of automaticity in spelling words in L1 in L2 reading-while-listening performance. Just as in the case of reading, dyslexia status was not a unique contributor to the variance in reading-while-listening scores. A potential reason for this finding is that a mixed-effects modelling analysis of the same dataset (Košak-Babuder et al.,forthcoming) has indicated that this multi-modal condition equalizes the language comprehension performance of dyslexic and non-dyslexic students. This is also supported by the fact that over and above orthographic processing ability, which was assessed by the dictation task, none of the L1 written word-decoding measures account for variability in performance.

Conclusions and implications

Our study investigated the differences between low-level L1 skills, L2 reading and listening and reading-while-listening outcomes of young dyslexic and non-dyslexic language learners. We also examined the relationship between low-level L1 skills and L2 reading, reading-while-listening and listening performance among young Slovenian learners of English. The findings show that, in Slovenian, which is a transparent language, dyslexic students are still behind their non-dyslexic peers in word-level L1 skills after five years of literacy instruction. Therefore, one of the important conclusions of the study is that, in conjunction with other diagnostic tests, these word-level L1 measures might still be used in this age group as predictors of dyslexic type learning difficulties. As our regression analyses reveal, word-level L1 skills, in particular the accuracy and speed of real and non-word reading, might also serve as useful indicators of L2 reading difficulties of young language learners. Another novel contribution of our study is the finding that children's ability to spell words accurately and quickly in their L1 was related to how well they understand L2 texts through spoken and multi-modal channels. This suggests that L1 dictation tests might yield potential diagnostic information on young learners' L2 listening and reading-while listening problems. Further research is, however, necessary to examine the contributions of other cognitive factors, such as working memory, processing and word naming speed, to language comprehension across different age groups.

Our results also call attention to the fact that students with weak L2 reading and listening skills might not always be at risk of, or diagnosed as having, dyslexia. In Slovenian, which has a transparent orthography, reading speed and accuracy measures in L1 might not be sensitive enough after the initial years of learning to read to detect subtle differences among children. Highly specific phonological processing tests might be necessary to reliably distinguish low-achieving L2 learners and those with literacy related learning difficulties (Borodkin & Faust, 2014). Although our results do not contradict Sparks and Ganschow's (1993) Linguistic Coding Differences Hypothesis and are not incompatible with Geva and Ryan's (1993) common underlying processes framework, they show that there are important additional factors that explain L2 reading and listening performance over and above L1 literacy measures. Alderson et al. (2015) argue that in diagnosing L2 reading difficulties, L1 measures should be complemented with tests of L2 skills and knowledge. Van Gelderen et al's study (2004) calls particular attention to the significant role of L2 vocabulary knowledge in predicting L2 reading outcomes and Vandergrift and Baker (2011) highlight the importance of L1 vocabulary knowledge in L2 listening. Unfortunately, in our study, due to constraints on testing time with children, we could not administer L1 literacy tests and assess children's L2 vocabulary and syntactic knowledge. Nonetheless, the findings with regard to the predictive role of low-level L1 skills in L2 reading, reading-while-listening and listening also yield significant new information that can assist in the valid and reliable diagnosis of L2 reading (Alderson et al., 2015) and listening difficulties (Harding, Alderson & Brunfaut, 2015).

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Table 1. The order of presentation of tasks

Group	N	Task 1	Task 2	Task 3
1	44	Read Text A & B	Listen Text C	Listen & Read Text D
2	44	Listen Text C	Listen & Read Text D	Read Text A & B
4	44	Read Text A & B	Listen Text D	Listen & Read Text C
5	44	Listen Text D	Listen & Read Text C	Read Text A & B
6	26	Read Text C & D	Listen Text A	Listen & Read Text B
7	26	Listen Text A	Listen & Read Text B	Read Text C & D
8	26	Read Text C & D	Listen Text B	Listen & Read Text A
9	26	Listen Text B	Listen & Read Text A	Read Text C & D

Table 2. The correlation of low level L1 skills and L2 reading, listening and reading-while listening tests (n= 276)

	L2 Listening	L2 Reading-while listening	L1 Timed reading	L1 Phonological awareness	L1 Non-word reading	L1 Dictation
L2 Reading	.478**	.663**	.428**	.260**	.356**	.342**
L2 Listening		.440**	.262**	.129*	.122*	.328**
L2 Reading-while listening			.237**	.134*	.204**	.311**
L1 Timed reading				.241**	.536**	.470**
L1 Phonological Awareness					.301**	.340**
L1 Non-word reading						.326**

* p<.05; ** p<.001

Table 3. Differences between dyslexic and non-dyslexic students in low-level L1 skills and L2 reading, listening and reading-while listening tests (n= 276)

	Group	Mean	SD
L1 Timed reading	Non-dyslexic	69.19	12.98
	Dyslexic	56.34	11.28
L1 Phonological awareness	Non-dyslexic	9.02	1.19
	Dyslexic	8.09	1.28
L1 Non-word reading	Non-dyslexic	32.25	5.30
	Dyslexic	27.37	6.02
L1 Dictation	Non-dyslexic	15.50	2.80
	Dyslexic	11.46	2.897
L2 Reading	Non-dyslexic	4.44	1.55
	Dyslexic	3.03	1.88
L2 Reading while listening	Non-dyslexic	4.68	1.54
	Dyslexic	3.83	1.90
L2 Listening	Non-dyslexic	4.20	1.74
	Dyslexic	2.69	2.14

Table 4. The distribution of dyslexic and non-dyslexic students among poor, average and strong performers in the L2 reading, listening and reading-while-listening tests (n= 276)

Test	Category		Non- Dyslexic	Dyslexic
L2 Reading	poor	Count	37	18
		Expected Count	46.4	8.6
		% within Dyslexia status	15.9	41.9
		Std. Residual	-1.4	3.2
	average	Count	132	23
		Expected Count	130.9	24.1
		% within Dyslexia status	56.7	53.5
		Std. Residual	.1	-.2
	strong	Count	64	2
		Expected Count	55.7	10.3
		% within Dyslexia status	27.5	4.7
		Std. Residual	1.1	-2.6
L2 Listening	poor	Count	48	22
		Expected Count	59.1	10.9
		% within Dyslexia status	20.6%	51.2%
		Std. Residual	-1.4	3.4
	average	Count	109	15
		Expected Count	104.7	19.3
		% within Dyslexia status	46.8	34.9
		Std. Residual	.4	-1.0
	strong	Count	76	6
		Expected Count	69.2	12.8
		% within Dyslexia status	32.6	14.0
		Std. Residual	.8	-1.9
L2 Reading-while listening	poor	Count	26	9
		Expected Count	29.5	5.5
		% within Dyslexia status	11.2%	20.9%
		Std. Residual	-.7	1.5
	average	Count	207	34
		Expected Count	203.5	37.5
		% within Dyslexia status	88.8%	79.1%
		Std. Residual	.2	-.6

Table 5 Regression analysis examining the contribution of low-level L1 skills and dyslexia identification to L2 reading performance (n= 276)

Variable	B	*SE* B	*β*	Part-correlation
L1 Timed reading	.031	.008	.251**	.196
L1 Phonological awareness	.142	.077	.105	.097
L1 Non-word reading	.039	.019	.131*	.108
L1 Dictation	.053	.035	.099	.079
Dyslexia status	-.475	.285	-.102	-.088
R^2	.246			
F	17.63**			

* p<.05 ** p<.001

Table 6 Regression analysis examining the contribution of low-level L1 skills and dyslexia identification to L2 listening performance (n= 276)

Variable	B	*SE* B	β	Part-correlation
L1Timed reading	.021	.010	.148*	.116
L1 Phonological awareness	-.004	.092	-.002	-.002
L1 Non-word reading	-.025	.023	-.077	-.063
L1 Dictation	.123	.042	.207*	.166
Dyslexia status	-.869	.339	-.167*	-.144
R^2	.145			
F	9.18**			

Table 7 Regression analysis examining the contribution of low-level L1 skills and dyslexia identification to L2 reading-while-listening performance (n= 276)

Variable	B	*SE* B	*β*	Part-correlation
L1 Timed reading	.009	.009	.072	.057
L1 Phonological awareness	.011	.081	.009	.008
L1 Non-word reading	.022	.020	.077	.064
L1 Dictation	.121	.037	.236**	.190
Dyslexia status	-.127	.298	-.028	-.024
R^2	.113			
F	6.86**			

* p<.05 ** p<.001

Appendix 1. Descriptive statistics and reliability analysis of texts by mode

Text and mode	Cronbach's alpha	Mean non-dyslexic (SD)	Mean dyslexic (SD)	Mean total sample (SD)
A reading-only	.82	4.11 (2.05)	2.34 (2.00)	3.83 (2.10)
A reading-while listening	.83	3.92 (2.11)	4.30 (1.94)	4.02 (2.04)
A listening-only	.82	3.36 (2.01)	1.63 (2.24)	3.11 (2.12)
B reading-only	.77	4.39 (1.74)	2.79 (1.99)	4.14 (1.86)
B reading-while listening	.72	4.62 (1.45)	2.90 (2.25)	4.37 (1.68)
B listening-only	.80	4.03 (2.00)	2.50 (1.67)	3.55 (2.02)
C reading-only	.75	4.41 (1.58)	3.00 (2.04)	4.13 (1.76)
C reading-while listening	.68	4.34 (1.51)	3.00 (1.65)	4.15 (1.58)
C listening-only	.71	4.29 (1.51)	1.91 (1.67)	3.92 (1.76)
D reading-only	.76	5.09 (1.42)	4.04 (1.85)	4.90 (1.55)
D reading-while listening	.58	5.44 (1.03)	4.64 (1.15)	5.30 (1.09)
D listening-only	.66	4.89 (1.29)	4.16 (1.89)	4.79 (1.39)