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ABSTRACT

Many children with developmental language disorder (DLD) are reported to have word reading difficulties. However, previous research has focused mostly on monolingual children. The present study used two existing datasets to assess word reading outcomes of bilingual children with DLD. In Study 1, we compared word reading outcomes of monolingual and bilingual children with and without DLD (n = 93 monolingual DLD; n = 33 bilingual DLD, n = 42 monolingual TD; n = 74 bilingual TD). In Study 2, we compared those of monolingual (n = 91) and bilingual children with DLD (n = 51) on the basis of school record data. Findings from both studies show mean poor word reading outcomes and a high incidence of poor readers in the groups of children with DLD. Despite lower oral language outcomes of bilingual children in the mainstream language, reading outcomes of monolingual and bilingual children (with/without DLD) did not differ or outcomes were even better for the bilingual children. Overall, these findings indicate that DLD is a risk factor for word reading difficulties, while bilingualism is not.

1. Introduction

The ability to communicate through both oral and written language is important for functioning in daily life, academic outcomes, employment and for well-being. Those with oral language difficulties or with word reading difficulties face more obstacles in these areas (e.g., Conti-Ramsden, Durkin, Mok, Toseeb, & Botting, 2016; Conti-Ramsden, Durkin, Toseeb, Botting, & Pickles, 2018; Francis, Caruana, Hudson, & McArthur, 2019; Richardson & Wydell, 2003; Yew and O'Kearney, 2013). One particular group of children runs the risk of having word reading problems in addition to their poor oral language. This is the group of children with developmental language disorder (DLD). So far, studies have focused mostly on the comorbidity of oral language and word reading deficits in monolingual children with DLD. In the present study, we evaluate whether this pattern of word reading deficits is the same for monolingual and bilingual children with DLD.

1.1. Importance of word reading

Accurate and fluent word reading is important for the population in general. First, word reading is one essential component for developing reading comprehension (Hoover & Gough, 1990; Lervåg, Hulme, & Melby-Lervåg, 2017), a vital skill in literate societies. Second, word reading ability affects the amount of reading that a child will do (van Bergen, Vasalampi, & Torppa, 2020); better readers will read more, which will lead to more print exposure. Frequent print exposure, in turn, is assumed to support general verbal skills and vocabulary size (e.g. Cain & Oakhill, 2011; Florit & Cain, 2011; Mol and Bus, 2011). Furthermore, exposure to orthographic forms, through reading, can facilitate word learning (Ricketts, Bishop, & Nation, 2009; Rosenthal & Ehri, 2008). Good word reading abilities can thus impact on reading comprehension and vocabulary knowledge.

1.2. DLD and word reading

DLD is a clinical condition severely impacting on oral language

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learning, despite normal hearing, average nonverbal intelligence and adequate language input (Leonard, 2014). Approximately 5–7 % of kindergarten children can be taken to have DLD (Norbury et al., 2016; Tomblin et al., 1997). Although the word reading growth trajectories of children with DLD and their typically developing (TD) peers are similar, the word reading outcomes of children with DLD are generally lower than those of their TD peers (Catts, Sittner Bridges, Little, & Tomblin, 2008). Furthermore, a considerable proportion of children with DLD display word reading difficulties (between 31 % and 72 %) (e.g., Bishop, McDonald, Bird, & Hayiou-Thomas, 2009; Catts, Adlof, Hogan, & Ellis Weismer, 2005; de Bree, Wijnen, & Gerrits, 2010; de Groot, Van den Bos, Van der Meulen, & Minnaert, 2015; McArthur, Hogben, Edwards, Heath, & Mengler, 2000; Ramus, Marshall, Rosen, & van der Lely, 2013; Rispens & Parigger, 2010; Snowling et al., 2019; van Weerdenburg, Verhoeven, Bosman, & van Balkom, 2010; Vandewalle, Boets, Ghesquiere, & Zink, 2012).

Different interpretations have been posited for this high incidence of word reading difficulties in children with DLD (e.g., Bishop et al., 2009; Bishop & Snowling, 2004; Catts et al., 2005; Pennington & Bishop, 2009). The accumulated evidence indicates that word reading deficits in children with DLD are a comorbid difficulty: Only part of the children with DLD also has literacy deficits, which seems to be due to different underlying risk factors. Generally, many children with DLD exhibit phonological processing difficulties, regardless of whether they also have reading difficulties. In contrast, children with DLD + severe word reading difficulties exhibit poorer performance on rapid automatized naming (RAN) than typically developing children and their DLD peers without severe word reading difficulties (e.g., Bishop et al., 2009; Snowling et al., 2019 Vandewalle et al., 2012, see also Brizzolara et al., 2006 for adolescents with a history of language disorder and severe and persistent word reading difficulties). The finding that RAN, the ability to quickly name familiar symbols, distinguishes between those children with DLD who have comorbid severe and persistent word reading difficulties and those who do not fits the literature showing that RAN is a unique and main underlying skill of word reading fluency that is poor in people with word reading difficulties (e.g., Araújo & Faísca, 2019; Kirby, Georgiou, Martinussen, & Parrila, 2010).

The finding that RAN is poor in children with DLD + severe word reading difficulties rather than in children with DLD in general indicates that the word reading difficulties are not a consequence mainly of children's poor language abilities, but of poor literacy-specific skills. This does not mean that language abilities do not interact with word recognition. As mentioned, word reading is assumed to support verbal skills and vocabulary size (e.g., Cain & Oakhill, 2011; Florit & Cain, 2011; Mol and Bus, 2011), but the reversed effect has also been reported. Specifically, prevalent models of reading, such as the connectionist model of reading (Harm & Seidenberg, 2004) and the lexical quality hypothesis (Perfetti, 2007), point to the importance of vocabulary in word reading. It has, for example, been proposed that a smaller vocabulary hampers word recognition (Gottardo, Collins, Baciu, & Gebotys, 2008; Nation & Snowling, 1998; Verhoeven, 2000). While cognitive tasks more closely related to literacy, such as RAN, play a more decisive role in word reading development, poor vocabulary can thus constitute an additional risk factor for word reading problems (e.g., Duff, Reen, Plunkett, & Nation, 2015; Torppa, Lyytinen, Erskine, Eklund, & Lyytinen, 2010; van Viersen et al., 2017).

Children with DLD often have a smaller vocabulary than typically developing children (e.g., Kan & Windsor, 2010; McGregor, Oleson, Bahnsen, & Duff, 2013; Rice & Hoffman, 2015). The poor vocabulary of children with DLD can hinder their word reading development, and, vice versa, additional word reading difficulties could associate with children's vocabulary difficulties. Insight into the word reading abilities of children with DLD is thus important for understanding the support these children need.

1.3. Bilingualism and word reading

This insight and understanding is also needed for the subgroup of bilingual children with DLD. The potential influence that bilingualism in general has on word-reading development has been receiving increasing attention. As there is no agreed-upon definition of bilingualism, we indicate that we take bilingual (or multilingual) children to be those who receive "regular input in two or more languages during the most dynamic period of communication development" (Kohnert, 2010, p. 456).

Generally, word reading accuracy and fluency outcomes in the orthography taught at school are similar for monolingual and bilingual peers when both groups have started literacy instruction at the same time (Geva, Wade-Woolley, & Shany, 1997; Geva & Yaghoub Zadeh, 2006; Lesaux & Siegel, 2003; Verhoeven, 2000). Furthermore, bilingual children follow the same trajectory of word recognition skills as their monolingual peers (Geva & Wiener, 2016 in Geva, Xi, Massey-Garrison, & Mak, 2019; Verhoeven, 2000). Bilingual children thus generally do not show delayed word reading (see also the review by Geva et al., 2019, and the meta-analysis of Melby-Lervåg & Lervåg, 2014) and literacy instruction in a second language is equally effective as in the first language (Kim, Lee, & Zuilkowski, 2020). These results are found despite the sometimes lower oral language outcomes of bilinguals in the target language. Vocabulary, specifically, has been found to be sensitive to the distributed nature of bilingual children's language input (e.g., Hoff et al., 2012; Unsworth, 2013). Even though weak vocabulary can influence word recognition, as mentioned, this does not seem to associate with word reading abilities in bilingual children.

The pattern of findings for the subset of monolingual and bilingual children with dyslexia is the same as for the general population. Dyslexia is a disorder characterized by consistently poor word reading and spelling performances that cannot be accounted for by general learning difficulties, sensory deficits, or inadequate teaching (Peterson & Pennington, 2015).Vender and Melloni (2021) compared word reading in Italian monolingual and bilingual children with and without dyslexia. The monolingual and bilingual groups did not differ from each other, but the groups with and without dyslexia did. This pattern was also attested in a study with Dutch monolingual and bilingual children with and without dyslexia (Verpalen & van de Vijver, 2015). It thus seems that exposure to more than one language does not influence general word reading outcomes in children with dyslexia.

1.4. DLD, bilingualism and word reading

The question is whether the word reading outcomes of bilingual children with DLD are the same as those of their monolingual peers. So far, the data on comorbid DLD and severe word reading difficulties are based on chiefly monolingual samples: studies have relied on data of monolingual children with DLD (Bishop et al., 2009; Catts, Fey, Tomblin, & Zhang, 2002; Catts, Adlof, Hogan, & Ellis Weismer, 2005; Vandewalle et al., 2012), mostly monolingual samples (de Groot et al., 2015; Snowling et al., 2019; van Weerdenburg et al., 2010) and of children with DLD who speak the mainstream language as their first language (McArthur et al., 2000). A monolingual sample is also assumed in the studies that have not referred specifically to the first/main languages of their samples (e.g., de Bree et al., 2010; Ramus et al., 2013; Rispens & Parigger, 2010). Word reading outcomes of bilingual children with DLD have thus not yet been the focus of research. However, in order to provide the required educational and special needs support for these children, it is relevant to establish whether bilingualism is associated with the word reading outcomes of these children.

We know of one study that has looked into this topic. Balilah and Archibald (2018) compared raw scores on word reading in monolingual and bilingual children (English language learners) with and without parental concerns about language development. They found that the children for whom there was parental concern about language

development ($n = 201$ monolingual; $n = 58$ bilingual) performed more poorly than those without such concerns, regardless of whether they were monolingual or bilingual. Furthermore, the bilingual groups ($n = 58$ with concerns; $n = 92$ without concerns) outperformed the monolingual groups ($n = 201$ with concerns; $n = 902$ without concerns) on (pseudo)word reading tasks. These findings suggest that there are no differences between monolingual and bilingual children with possible language problems in their reading outcomes, similar to findings reported above on the general monolingual and bilingual population and the monolingual and bilingual children with dyslexia. However, the children in this sample were not diagnosed with language deficits or with DLD specifically. Furthermore, the question addressed to parents was whether they had (had) concerns about their child's language development. It is not clear whether parents responded to this question on the basis of their child's oral language or also on their written language (including word reading). Finally, it is relevant to not only evaluate the mean word reading outcomes but also to compare the incidence of poor readers in the monolingual and bilingual groups. We will therefore assess whether similar word reading patterns are attested in monolingual and bilingual children with diagnosed DLD.

1.5. Present study

In the present study, we look into word reading outcomes of monolingual and bilingual children with DLD, using two unrelated datasets that had been collected for different purposes. In the first study, we compared groups of children who are either monolingual or bilingual and who are either diagnosed with DLD or have typical language development (TD) (i.e., monolingual DLD, bilingual DLD, monolingual TD, bilingual TD). The children's word and pseudoword reading outcomes were assessed in lower elementary grades. In the second study, we compared word reading outcomes of monolingual and bilingual children with DLD in upper elementary grades.

Our main aim was to compare standardized word reading performance of monolingual and bilingual children with DLD. Comparisons were made on mean word reading outcomes as well as on the distribution of poor readers in both groups, based on norm scores. The analyses were also conducted while controlling for vocabulary. There were four expectations for Study 1, based on the literature. First, we expect that the reading outcomes of the monolingual children with DLD are low and that the incidence of poor readers is considerable (Bishop et al., 2009; McArthur et al., 2000; Snowling et al., 2019).

Second, we expect that bilingualism as such does not influence children's word reading outcomes (Geva et al., 2019; Melby-Lervåg & Lervåg, 2014). Thus, although oral language outcomes, including vocabulary, of bilingual children might be lower in the mainstream language in comparison with monolingual peers (Raudszus, Segers, & Verhoeven, 2019; Verhoeven, 2000; overview in Unsworth, 2013), reading outcomes of monolingual and bilingual children were not expected to differ.

Third, we expected that the lower word reading outcomes of children with DLD are not associated with bilingualism, based on what has been found in typically developing groups, children with dyslexia (Vender & Melloni, 2021; Verpalen & van de Vijver, 2015) and children with possible language problems (Balilah & Archibald, 2018). However, we also reckoned with the possibility that bilingualism could associate with the reading outcomes of children with DLD. Previous work indicated that vocabulary is particularly weak in bilingual children with DLD in comparison with monolingual peers with DLD (Blom & Boerma, 2017), which may pose a risk for the word reading abilities of this group.

Finally, following the assumption that word reading outcomes of children with DLD are not associated with bilingualism, it could be expected that monolingual and bilingual children with DLD would show similar reading outcomes and incidence of poor readers, whereas bilingual children without DLD would show better word reading than bilingual children with DLD.

Expectations for Study 2 were twofold. First, the incidence of poor readers in the monolingual children with DLD is expected to resonate with that in the literature as well as that attested in Study 1. Second, monolingual and bilingual children with DLD were not expected to differ in their word reading outcomes and incidence of poor readers.

Data of Study 1 stems from a project on cognitive development of bilingual children (with and without DLD); school record data of Study 2 stems from a project on spelling development in children with DLD. No studies have been reported on the data of Study 2 as yet. Studies that have appeared on the data of Study 1 have not focused on the issue of word reading in monolingual and bilingual children (with or without DLD). One study has appeared on the reading outcomes of the monolingual children with DLD (Erisman & Blom, 2020).

2. Study 1. Word and pseudoword reading of monolingual and bilingual children with and without DLD in the lower elementary years

2.1. Method

2.1.1. Participants

Participants were monolingual and bilingual children with and without DLD who had been recruited in the context of a large research program CoDEmBi (cognitive development in emerging bilingualism). The present sample includes the children who performed word reading tasks (monolingual DLD, $n = 93$; monolingual TD $n = 42$; bilingual DLD, $n = 33$; bilingual TD, $n = 74$). These data were obtained at the third wave of the research program, when children were at the lower elementary years (Grades 1–3). Word reading tasks were not included in the test battery of the research program at waves 1 and 2. Some relevant background information of the participants, including nonverbal intelligence, parental education and amount of exposure to Dutch, was collected at wave 1. With the exception of this background information, only data from the third measurement wave is reported in the present study. Participant information is presented in Table 1.

2.1.1.1. TD and DLD. TD children were recruited via regular elementary schools in the Netherlands and there were no reported concerns about their language development. Children with DLD had all obtained a formal diagnosis of DLD before the start and independent of the abovementioned longitudinal study. Such a diagnosis is based on multidisciplinary assessment (speech language therapist, psychologist, audiologist) with clearly-defined criteria concerning severity and persistence of the language disorder (Gerrits, de Jong, Zwitserlood, & Klatte, 2019; NVLF, 2017; Stichting Siméa, 2014). This means that, at the time of diagnosis, the children with DLD obtained a score of −1.5 SD on at least two out of four language subscales (speech production, auditory processing, grammatical knowledge and lexical-semantic knowledge), or −2 SD on the total score of a language assessment test battery (Stichting Siméa, 2014). Furthermore, a diagnosis of DLD is based on exclusion criteria. Indeed, the participating children did not have hearing problems, intellectual disability, were not diagnosed with autism spectrum disorder, and did not have severe articulatory difficulties.

For bilingual children with DLD, the same criteria apply. At the time of diagnosis, parental information is obtained on whether language difficulties are present in both languages and on the amount of language input in both languages. Evaluation of performance on tasks tapping both languages is made when possible (Dutch guidelines; Stichting Siméa, 2016). In the recruitment of the current sample, we obtained parental information on the amount of language input in both languages (see Section 2.1.1.2).

Recruitment of the children with DLD took place through two Dutch organizations that provide diagnostic, care and educational services for children with language difficulties (Royal Dutch Kentalis and Royal

Table 1
Participant information per group.

	Monolingual				Bilingual				*F* (4 groups)
	Typically developing		DLD		Typically developing		DLD		
Nr girls/total	19/42		24/93		41/74		10/33		
Age at wave 3	7;86	(8.2)	7;88	(6.9)	7;60	(7.2)	7;90	(8.6)	3.540*
Wave 1 data									
Nonverbal IQ	106.76	(15.5)	93.68	(17.8)	96.81	(13.8)	94.45	(15.1)	6.890***
Parental education	6.72	(1.8)	5.49	(2.3)	4.99	(2.2)	5.65	(2.1)	6.467***
% exposure to Dutch at home	N/A		N/A		53.42	(13.6)	45.49	(16.3)	
Wave 3 data									
Receptive vocabulary	108.76	(11.8)	97.12	(12.6)	96.32	(12.9)	83.62	(15.3)	23.036***
Sentence repetition#	35.00	(3.6)	21.97	(7.9)	30.28	(6.3)	18.45	(9.1)	23.036***
Word formation#	21.14	(3.5)	16.71	(4.1)	17.61	(3.9)	12.58	(5.1)	54.373***

*** $p < .001$.
* $p < .05$.
# Refers to raw scores.

Dutch Auris Group). At the onset of the study (wave 1), all children with DLD attended special education or regular education with ambulatory care. At wave 3, when the word reading tasks relevant for the present study were administered, the majority of the children with DLD still attended special education or regular education with ambulatory care (66 of the monolingual DLD children (71 %); 29 of the bilingual children with DLD (88 %)). It should be noted that the findings on word reading are the same for the whole group as well as the subset of children who still attended special education or had ambulatory care.

2.1.1.2. Monolingual and bilingual. Monolingual children had parents who always spoke Dutch with them. Bilingual children had one or both parents who were native speakers of a language other than Dutch and spoke their native tongue with the child throughout an extensive period of the child's life. This was determined with the *Questionnaire for Parents of Bilingual Children* (PaBiQ; Tuller, 2015). The bilingual TD group included children with three different other languages: Moroccan Arabic ($n = 11$), Tarifit Berber ($n = 37$) and Turkish ($n = 26$). The bilingual group with DLD included children with 13 different other languages: Chinese ($n = 2$), Danish ($n = 1$), Dari ($n = 2$), Egyptian Arabic ($n = 3$), Frisian ($n = 1$), Kirundi ($n = 1$), Moroccan Arabic ($n = 11$), Pashto ($n = 1$), Portuguese ($n = 1$), Russian ($n = 1$), Suryoyo ($n = 1$), Tarifit Berber ($n = 2$), and Turkish ($n = 10$). All participating children were born in the Netherlands.

2.1.1.3. Group characteristics. There were some overall differences between the groups. In terms of *composition*, the groups differed in distribution of sex $\chi^2(3) = 16.935$, $p < .001$. This was due to the DLD group as a whole containing more boys $\chi^2(1) = 15.562$, $p < .001$, as well as the monolingual group as a whole containing more boys $\chi^2(1) = 6.282$, $p = .012$. There was also an effect of age, with the bilingual TD group being significantly younger than the monolingual DLD group ($p = .019$). Furthermore, there was an effect of parental education, which was measured on a nine-point scale (1 = no education; 9 = university degree) with the PaBiQ: the parents of the monolingual TD group obtained significantly higher educational levels (*ps* < .01) than the other three groups. Finally, there were differences between the two bilingual groups in exposure to Dutch at home at wave 1 of the longitudinal study. This was also determined via the PaBiQ and calculated based on the amount of Dutch input relative to the total amount of input a child heard from his/her mother, father, siblings and other close adults. Comparisons between the group of bilingual children with and without DLD established that the amount of exposure to Dutch at home at wave 1 (5–6 years old) was lower for the bilingual children with DLD, $t(96) = 2.548$, $p = .012$.

To confirm the mean lower language outcomes of the children with DLD and the TD children and to compare the monolingual and bilingual groups we administered tasks assessing receptive vocabulary and grammatical abilities (sentence repetition, word formation i.e., noun and verb inflection) at the same age as the literacy tasks. Furthermore, a measure of non-verbal IQ (obtained at wave 1) was presented to ensure our sample did not contain children with general learning difficulties (see also Table 1). Differences between the groups are discernible. The monolingual TD group obtained significantly higher non-verbal IQ scores than the other three groups (*ps* < .01). Nonverbal IQ was measured with the *Wechsler Nonverbal-NL* (Wechsler & Naglieri, 2008, COTAN evaluation on reliability = sufficient; COTAN, 2009). Furthermore, the language data at wave 3 all rendered significant main effects, pointing to effects of bilingualism as well as DLD. The two TD groups outperformed the two DLD groups (monolingual TD, bilingual TD > monolingual DLD, bilingual DLD) on sentence repetition (subtest of the *Dutch Language Proficiency Test for All Children* [Taaltoets Alle Kinderen (TAK)]; Verhoeven & Vermeer, 2001, $\alpha > 0.80$), and the monolingual TD group outperformed all other groups (monolingual TD > bilingual TD > monolingual DLD, bilingual DLD, *ps* < .01). The patterns for these two tests, with raw scores, remained the same when age was taken into account. On receptive vocabulary (Peabody Picture Vocabulary test, PPVT-III-NL, $\lambda - 2 = 0.89$–0.97; Schlichting, 2005, percentile score) and word formulation (subtest of the TAK; Verhoeven & Vermeer, 2001, raw score), the pattern was monolingual TD > monolingual DLD = bilingual TD > bilingual DLD, *ps* < .01.

Given the differences between the groups, analyses were also conducted while controlling for nonverbal IQ, parental education and amount of exposure to Dutch. As we worked with standardized scores which already corrects for age, it was not necessary to control for age in our analyses. Of the group differences with respect to children's language outcomes, especially vocabulary is expected to have a relation with word reading outcomes. Therefore, vocabulary was included in the analyses as a covariate.

2.1.2. Instruments

2.1.2.1. Word reading fluency. Word reading fluency was assessed with the *Eén Minuut Test* (EMT, [One Minute Test]; Brus & Voeten, 1999). In this standardized test for word reading fluency, children have to read aloud as quickly and accurately as possible a list of 116 real words of increasing difficulty. On the basis of the number of words read correctly in 1 min, a standardized score (which thus takes age into account) is determined with a mean of 10 and a standard deviation of 3. Performance of a standard score of 6 or lower was considered poor (and refers to a percentile score of 8.8). Parallel form-reliability for Grades 1 to 3 ranges from 0.90 to 0.94 (van den Bos, Lutje Spelberg, Scheepstra, & de Vries, 1994).

2.1.2.2. Pseudoword reading fluency. Next to word reading fluency, we included a measure of pseudoword reading fluency (*Klepel*; Van den Bos,

Groot, & de Vries, 2019; van den Boset al., 1994). Pseudoword reading fluency is a more pure measure of decoding skills, as reliance on vocabulary is not possible, in contrast to word reading fluency. In the standardized test for pseudoword reading fluency, children read aloud as quickly and accurately as possible a list of 116 pseudowords of increasing difficulty. On the basis of the number of words read correctly in 2 min, a standardized score (which thus takes age into account) is determined with a mean of 10 and a standard deviation of 3. Performance of a standard score of 6 or lower was considered poor (and refers to a percentile score of 8.8). Parallel-form reliability for Grades 1 to 3 ranges from 0.93 to 0.95 (van den Bos et al., 1994; Van den Bos et al., 2019).

2.1.3. Procedure

Data stems from wave 3 from a longitudinal study. This longitudinal study was conducted between 2014 and 2016. There were on average 11 months between each data wave. The study was approved by the Ethical Assessment Committee of the Faculty of Social and Behavioral Sciences at Utrecht University (22-0098), in line with ALLEA, and thereby following human subjects guidelines. Parents of participants signed an informed consent form. Children were individually tested in a quiet room at their school. Trained research assistants followed a strict protocol and administered a test battery, consisting of language, memory and attention tasks, in two separate sessions. Each test session lasted approximately 1 h. The reading measures were only administered at wave 3, as the third and fourth task in the first session. The other measures of the test battery at this data collection wave were similar to the measures administered at waves 2 and 3.

2.1.4. Analyses

In order to evaluate the word reading outcomes for the groups in this dataset, we used multivariate analyses of variance with language ability (TD, DLD) and language group (monolingual, bilingual). Word and pseudoword reading outcomes were entered as dependent variable and language ability (TD, DLD) and language group (monolingual, bilingual) as fixed factors. Similar analyses with nonverbal IQ, parental education and amount of exposure to Dutch as covariates did not affect the pattern of results and will therefore not be reported. Controlling for vocabulary did affect the results and analyses including vocabulary as covariate are therefore reported. The MANCOVA met the assumptions of linearity and homogeneity of variance-covariances. To compare the DLD groups directly (in line with Study 2), the MANOVA was also conducted for the two DLD groups only.

2.2. Results

2.2.1. Mean word-level reading outcomes

There were no outliers on the word and pseudoword reading tasks (z-scores <> 3.29, Field, 2013). Although tests of normality showed significant effects (word reading: Shapiro Wilk = 0.973, $p < .001$; pseudoword reading: Shapiro Wilk = 0.972, $p < .001$), skewness and kurtosis values were acceptable (word reading: skewness = −0.77, kurtosis = −0.610; pseudoword reading: skewness = −0.304, kurtosis = −0.520).

The results on the word and pseudoword reading tasks are presented in Table 2. The mean outcomes of the TD groups are above average, whereas those of the DLD groups are below average. The outcomes of the two tasks are highly correlated, $r = 0.899$, $p < .001$.

There was an effect of language ability, $F(2, 237) = 35{,}961$ $p < .001$, $\eta_p^2 = 0.233$ (TD > DLD). The effect of language group just fell outside significance, $F(2, 237)$ 3.015, $p = .051$, $\eta_p^2 = 0.025$, with bilingual > monolingual. There was no interaction between language ability and language group, $F(2, 237) = 0.721$, $p > .05$. This pattern was also attested for the tasks separately.

When vocabulary was entered as a covariate, there were effects of language ability, $F(2, 235) = 20.534$ $p < .001$, $\eta_p^2 = 0.149$ (DLD < TD), and of language group $F(2, 235) = 5.372$ $p = .015$, $\eta_p^2 = 0.044$ (bilingual > monolingual), but no interaction between the two $F(2, 235) = 1.104$, $p = .330$. The same was true for word reading and pseudoword reading separately. Thus, when vocabulary was controlled for, the DLD group showed lower word reading outcomes than the TD group and the bilingual group obtained higher word reading outcomes than the monolingual group.

Finally, a direct comparison between the outcomes of the two DLD groups-only (monolingual DLD, bilingual DLD) does not show an overall difference, Wilk's Lambda $F(2,123) = 2.725$, $p = .069$, $\eta_p^2 = 0.042$, and no difference on word reading separately, $F(1, 125) = 0.993$, $p = .321$, $\eta_p^2 = 0.008$. The numerically better reading outcomes of the bilingual DLD group on pseudoword reading just falls outside of significance $F(2, 125) = 3.863$, $p = .052$, $\eta_p^2 = 0.030$. When entering vocabulary as a covariate, significant differences surface across-the-board, with bilingual DLD outperforming monolingual DLD: multivariate $F(2,121) = 4.164$, $p = .019$, $\eta_p^2 = 0.064$, word reading $F(1, 125) = 5.348$, $p = .022$, $\eta_p^2 = 0.042$, and pseudoword reading $F(1, 125) = 8.348$, $p = .005$, $\eta_p^2 = 0.064$.

2.2.2. Distribution of poor readers

The number of poor readers on the word and pseudoword reading task is presented in Table 2. The distributions are virtually equal for the two reading tasks. The DLD groups contained more children who read below the clinical threshold than the TD groups; the bilingual groups showed somewhat lower percentages of poor readers than the monolingual groups.

Fig. 1 presents the distribution of readers when combining performance of the word and pseudoword reading tasks. Here too, TD groups show a large majority of average to good readers, whereas the DLD groups show a much higher percentage of poor readers.

Together, the findings indicate that word-level reading problems exist in the presence of a language disorder and not in association with being bilingual. If anything, there were some indications that the bilingual readers outperformed the monolingual readers, when controlling for their smaller receptive vocabulary in Dutch. Furthermore, the distributions of poor readers in the two DLD groups did not differ.

Table 2
Word reading outcomes per group.

	Monolingual				Bilingual			
	Typically developing		DLD		Typically developing		DLD	
Word reading								
Mean outcomes	11.45	(4.0)	6.96	(4.0)	11.49	(3.6)	7.73	(3.3)
Nr. poor readers	4/42	(10.1 %)	41/93	(44.1 %)	5/74	(6.7 %)	9/33	(27.3 %)
Pseudoword reading								
Mean outcomes	11.38	(8.35)	6.89	(3.6)	11.73	(3.1)	8.27	(2.9)
Nr. poor readers	4/42	(10.1 %)	41/93	(44.1 %)	3/71	(4.2 %)	9/33	(27.3 %)

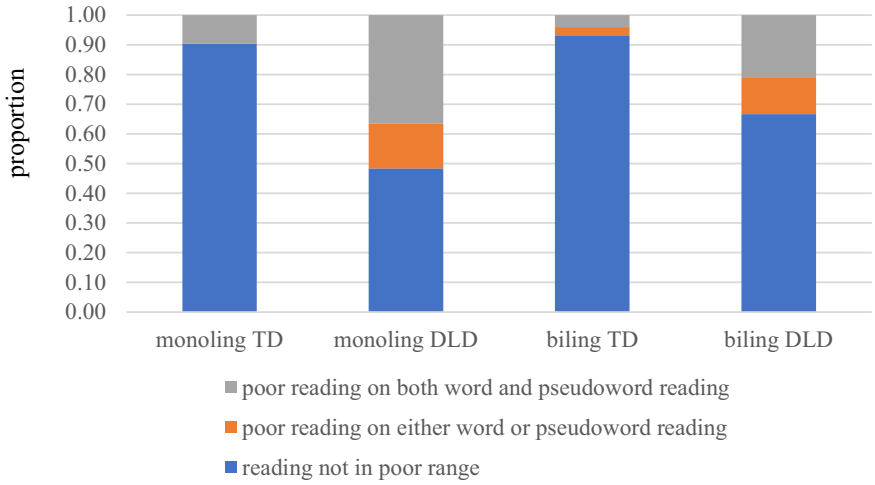

Fig. 1. Distribution of word and pseudoword reading performance per group.

3. Study 2. Word reading of monolingual and bilingual children with DLD in the upper elementary years

3.1. Method

3.1.1. Participants

The participants were children with a diagnosed DLD. Criteria for DLD were the same as in Study 1. All children attended special education in the higher upper elementary years (Grades 4–6), which means that their language difficulties were still severe and required intensified and specialized education. The monolingual and bilingual children thus attended the same schools of an organization that provides diagnostic, care and educational services for children with language difficulties (Royal Dutch Auris Group). The group consisted of 91 monolingual children with DLD (Mean age = 11 years 5 months, *SD* = 7.6 months, 27 girls) and 56 bilingual children with DLD (Mean age = 11 years, 4 months, *SD* = 7.8 months, 14 girls). The children in the monolingual and bilingual groups did not differ in mean age $t(145) = 1.154$, $p = .250$, in distribution of sex $\chi^2(1) = 0.376$, $p = .540$, and in grade $\chi^2(1) = 3.902$, $p = .102$. In contrast to Study 1, background information on language exposure, parental education and non-verbal intelligence was not obtained in Study 2.

The bilingual DLD group included children with (at least) 14 different other languages: Arabic ($n = 7$), Azeri ($n = 1$), Tarifit Berber ($n = 2$), Chinese ($n = 6$), English ($n = 2$), Hungarian ($n = 1$), Papiamento ($n = 1$), Pashto ($n = 2$), Polish ($n = 8$), Portuguese ($n = 1$), Spanish ($n = 3$), Tamil ($n = 1$), Turkish ($n = 12$), Vietnamese ($n = 3$). This information was unavailable for five children. The information on the bilingual background was provided to us by the teachers of the special education school the children attended.

To confirm the mean lower language outcomes of the children with DLD and the TD children and to compare the monolingual and bilingual groups, task outcomes of receptive vocabulary and grammar (sentence repetition and sentence formation) were obtained from the special education school the children were attending, see Table 3. Mean outcomes on receptive vocabulary (PPVT, similar to Study 1), sentence repetition and sentence formulation are presented in Table 3. Both the sentence repetition task and the sentence formulation task were subtests from the Dutch version of the Clinical Evaluation of Language Fundamentals (CELF-4-NL; Kort, Compaan, Schittekatte, & Dekker, 2008, sentence repetition $\alpha = 0.91$, sentence formulation $\alpha = 0.78$). The information on language outcomes is available for a subset of children, as data were requested from the special education schools and was not collected by the researchers. Both groups clearly obtain low results on these tasks. On the basis of the available data, the bilingual group obtained significantly lower outcomes than the monolingual group on receptive vocabulary and sentence formulation, but not on sentence repetition.

Table 3
Mean language outcomes per group.

	Monolingual with DLD		*n*	Bilingual with DLD		*n*	*t*
Receptive vocabulary	84.75	(10.7)	67	77.31	(11.7)	48	3.525***
Sentence repetition	3.13	(1.81)	64	2.56	(1.47)	45	1.742
Sentence formulation	5.50	(2.03)	76	4.53	(2.04)	49	2.600**

*** $p < .001$.
** $p < .01$.

3.1.2. Instruments

3.1.2.1. Word reading. Word reading was measured with the *Drie Minuten Toets* ([Three Minutes Test]; van Til et al., 2018, criterion-related validity; $r \geq 0.86$), a national curriculum-based test used to measure word reading fluency both halfway through and at the end of each school year. The task consists of three lists of 150 words each: respectively monosyllabic words without consonant clusters (e.g., koe, *cow*), monosyllabic words with consonant clusters (e.g., bloem, *flower*), and multisyllabic words (e.g., groente, *vegetable*). Children were asked to read each list as quickly and accurately as possible for 1 min. The score consisted of the total number of words read correctly. Raw scores are converted to reading levels, ranging from 1 through 5 (1 = percentiles 75–100; 2 = percentiles 50–75; 3 = percentiles 25–50; 4 = percentiles 10–25; 5 percentiles 0–10). Level 5 thus refers to poor readers.

3.1.3. Procedure

Data stems from a cross-sectional study focused on spelling in children with DLD. This study was conducted in 2019–2020. It was approved by the Ethical Assessment Committee of the Faculty of Social and Behavioral Sciences at the University of Amsterdam (2019-CDE-11491), in line with ALLEA, and thereby following human subjects guidelines. Parents of participants signed an informed consent form. Children's word reading outcomes were retrieved from the schools.

3.1.4. Analyses

In order to evaluate the word reading outcomes, mean raw word reading scores were compared between the two DLD groups (monolingual, bilingual) using a *t*-test. A univariate ANCOVA with receptive

vocabulary as a covariate was also conducted. Furthermore, the distribution of poor readers was compared between the two groups, using chi-squared analyses.

3.2. Results

Data screening of the raw correct scores showed that there are no outliers on the word reading task (*z*-scores <> 3.29). Numerically, the monolingual group with DLD (Mean = 183.1, *SD* = 69.3) obtains lower outcomes than the bilingual group with DLD (Mean = 196.7, *SD* = 54.2), but this difference is not significant, $t(144) = 1.246$, $p = .215$. This finding remains the same when vocabulary is entered as a covariate, $F(1,113) = 0.136$, $p = .713$.

The distribution on word reading fluency in five reading levels is presented in Fig. 2. In the monolingual group, 49 % obtained the word-reading outcomes at/below the 10th percentile, for the bilingual group this is 33 %. Chi-squared analysis showed the percentage of poor performers (at/below the 10th percentile) in both groups is significantly different $\chi^2(1) = 3.908$, $p = .049$. There are thus more monolingual children with DLD performing at/below the 10th percentile than bilingual children with DLD.

The comparison of word reading outcomes of monolingual and bilingual children with DLD in Grades 4 to 6 indicates that lower word-level reading outcomes are associated with the presence of a language disorder and not with being bilingual: Although the bilingual group obtained significantly lower results on language tasks, there were no differences between the groups on mean reading outcomes and a lower proportion of the bilingual children performed at/below the lowest 10th percentile.

4. Discussion

In the present study, we aimed to evaluate word reading in bilingual children with clinically diagnosed DLD. We determined whether their standardized word reading performance is related to DLD, with mean lower word reading outcomes and a relatively high incidence of poor word readers, similar to monolingual children (Bishop et al., 2009; McArthur et al., 2000; Snowling et al., 2019), or whether being bilingual is an additional risk factor for poor word reading outcomes. This was done in Study 1, with a sample of children attending Grades 1–3, and in Study 2, with a sample of children attending Grades 4–6. Furthermore, Study 1 included data of typically developing bilingual and monolingual children to ascertain the effects of and potential interactions between language group (monolingual, bilingual) and language ability (typically developing, DLD).

4.1. Word reading in monolingual and bilingual children with DLD

The findings of the two studies suggest that bilingual children with DLD do not run a greater risk for severe word reading difficulties than monolingual children with DLD: the mean word reading outcomes of the two DLD groups did not differ from each other. Furthermore, in Study 1, bilingualism did not associate with the poor reading outcomes of children with DLD. These findings agree with those of Balilah and Archibald (2018), who found that (pseudo)word reading differentiated children with or without parental concerns about language development regardless of language group (monolingual, bilingual).

In terms of the distribution into poor readers, a considerable percentage of monolingual children with DLD showed poor reading outcomes (Study 1: 44 %, Study 2: 49 %), in line with the literature (Bishop et al., 2009; Catts et al., 2002; de Bree et al., 2010; McArthur et al., 2000; Ramus et al., 2013; Rispens & Parigger, 2010; Snowling et al., 2019; van Weerdenburg et al., 2010; Vandewalle et al., 2012). The percentage of bilingual children with DLD with poor word reading outcomes was lower (Study 1: 27 %; Study 2: 33 %). This difference between monolingual and bilingual children with DLD was tested in Study 2 and was significant. Together, the findings indicate that word reading difficulties in bilingual children with DLD are mainly related to their DLD status and not to their bilingualism.

The purpose of the current study was to study the word reading outcomes of monolingual and bilingual children with diagnosed DLD (compared to those of monolingual and bilingual TD children in Study 1). Our findings confirm that children with DLD run an increased risk of literacy difficulties and that this pattern is the same for monolingual and bilingual children. They also indicate that not all children with diagnosed DLD are poor readers. These are all results that are important for educational and clinical practice.

One avenue for further research is to compare literacy outcomes of children with DLD attending special and regular education. Such an approach could take educational experience, especially literacy instruction provided into account. In Study 1, the children with DLD attended either special education or regular education but were not matched to the TD children at regular schools. In Study 2, the monolingual and bilingual children with DLD all attended special education and came from the same schools. Although the pattern of findings is similar across these two studies, more systematic comparisons especially concerning monolingual and bilingual children with DLD and their TD peers in regular education would be welcome. Such studies can shed light on literacy outcomes for subgroups of children with DLD (special education, ambulatory care, no additional care) in light of severity and profile of the language disorder and literacy education provided.

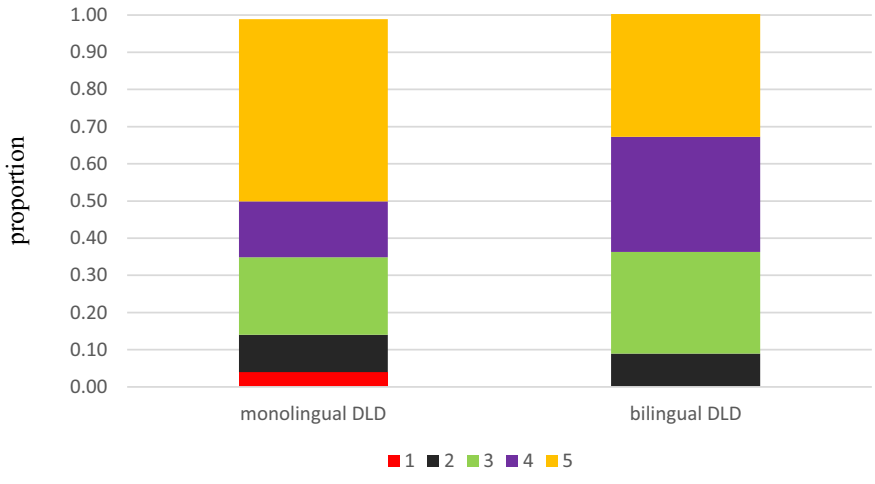

Fig. 2. Distribution of word reading fluency level per group (1 highest, 5 lowest).

Similarly, future research could assess whether this pattern of reading outcomes in monolingual and bilingual children would be the same for children with weaker language abilities but no diagnosed DLD.

4.2. No disadvantage for bilingual children in word reading

Despite lower oral language outcomes of bilingual children in the mainstream language, reading outcomes of monolingual and bilingual children did not differ or outcomes were even better for the bilingual children. These results agree with findings in the literature that similar word reading accuracy and fluency outcomes are attested for monolingual and bilingual typically developing children in the orthography taught at school (Geva et al., 2019; Melby-Lervåg & Lervåg, 2014). This indicates that oral language is not the strongest predictor of word reading outcomes. However, our results also show that vocabulary knowledge might contribute to reading outcomes, in line with studies that find that vocabulary can constitute an additional risk factor (e.g., Duff et al., 2015; Torppa et al., 2010; van Viersen et al., 2017). First, when vocabulary was controlled for, the difference between the bilingual and the monolingual children became significant in Study 1, indicating better performance of the bilingual children. Second, both bilingual groups (TD, DLD) in Study 1 showed numerically higher pseudoword reading outcomes than word reading outcomes. Word reading could be more dependent on vocabulary knowledge, whereas pseudoword reading could rely more on decoding as such.

4.3. Understanding the (small) differences between monolingual and bilingual children in word reading

We found that the bilingual group performed similarly or better than the monolingual group and that the incidence of poor word readers was numerically lower in the bilingual than in the monolingual DLD groups. These findings relate to those of Balilah and Archibald (2018). In their study on (pseudo)word reading in monolingual and bilingual children with possible language problems, they found that the bilingual groups (no concerns, language concerns) obtained higher reading scores than the monolingual groups (no concerns, language concerns).

The findings raise the questions of whether bilingual children in general might possess some kind of general (for literature on the debate concerning bilingual cognitive advantages, see e.g., Adesope, Lavin, Thompson, & Ungerleider, 2010; Gunnerud, Ten Braak, Reikerås, Donolato, & Melby-Lervåg, 2020; Paap, Johnson, & Sawi, 2014; Van den Noort et al., 2019) or specific reading-related advantage that facilitates learning to read and whether bilingual children with DLD are able to compensate for their word reading difficulties. The data in our studies cannot address these questions. Further research could compare the development of word reading abilities in monolingual and bilingual children with and without DLD. It can be assessed whether and how literacy-specific measures, such as RAN, phoneme awareness, and orthographic processing influence word reading. This approach could also add to the debate on the existence of a phonological advantage (phonological memory, phonological awareness) in bilinguals (see e.g., Bialystok, Majmuder, & Martin, 2003; Goriot, Unsworth, Van Hout, Broersma, & McQueen, 2021; Kaushanskaya & Marian, 2009; Kaushanskaya, 2012; Papagno & Vallar, 1995 for conflicting findings) and whether this positively influences their literacy acquisition. Such a longitudinal study could also be extended to include other measures and language ability groups. In terms of measures, it should include assessment of language abilities and general cognitive abilities, as well as information on behaviour and wellbeing. If such a study were conducted, this could also speak to the general issue of compensation of word reading ability (e.g., Haft, Myers, & Hoeft, 2016; van Viersen, de Bree, & de Jong, 2019) and can provide insight in the way literacy development can be shaped and supported.

4.4. Limitations

This study was intended as a first exploration of word reading outcomes in bilingual children with DLD. As existing datasets were used, the study is qualified by some limitations. One such limitation is that the dataset consisted of bilingual children with a heterogeneous language, socio-economic, cultural, and literacy background. It cannot, for instance, be ascertained whether there are differences between bilingual children who come from a language background with a written tradition and those who do not. The expectation is that there will be no differences between the two in word reading outcomes, as reading instruction takes place at school, but we cannot state this for certain.

Related, there were only three different bilingual backgrounds for the TD children in Study 1, whereas many more different combinations were reported for the children with DLD (13 in Study 1, and at least 14 in Study 2). We have some information to suggest that the heterogeneity of the groups does not impact the findings substantially. First, in the TD group, too, part of the bilingual background relates to a language with a written tradition and a part does not. Second, when we conducted a posthoc MANOVA on the data of Study 1, including only bilingual children with DLD with similar language backgrounds as those of the bilingual TD children, the pattern of findings remains exactly the same. For word reading there were no differences between the monolingual and bilingual TD children and no differences between the monolingual and bilingual DLD children, but poorer word reading outcomes for the (monolingual and bilingual) DLD children compared to the (monolingual and bilingual) TD children. Also, the percentage of poor readers remains approximately the same (26 % instead of 27 % for the entire bilingual DLD sample). Third, the word reading outcomes of the bilingual children with DLD (both with highly heterogeneous backgrounds) were similar, which is both reassuring for the finding and in line with general findings on reading outcomes in the language of instruction at school (Geva et al., 2019; Melby-Lervåg & Lervåg, 2014).

An additional limitation is that we only have word reading data of one timepoint. We therefore cannot draw any conclusions about the persistence of the word reading difficulties in the subset of (bilingual) children with DLD. Our findings are thus limited to indications of word reading difficulties (severity of the word reading problems), not to dyslexia (severity and persistence of the word reading difficulties despite adequate instruction) as such. Finally, the word reading tasks applied lead to different cut-offs. In Study 1, this cut-off is a scale score of 6 or lower, referring to percentile 8.8, whereas in Study 2, the outcome refers to a percentile score of 10 or lower. Nevertheless, both tasks tap word reading fluency and the pattern of findings is similar in the two studies.

4.5. Conclusion

Together, the current study demonstrated that both monolingual and bilingual children with DLD show poorer word reading outcomes than their TD peers. Both groups contain a larger percentage of children who can be labelled poor (word) readers. Furthermore, bilingual children with DLD do not show poorer word reading outcomes than their monolingual peers. The findings suggest that the word reading difficulties in bilingual children are not due to smaller vocabulary knowledge in the mainstream language in which literacy is taught, but might instead be specific to word reading. Future research is needed to further explore the role of both risk and protective factors of word reading.

CRediT authorship contribution statement

Elise H. de Bree: Conceptualization, Methodology, Formal analysis, Writing – original draft. **Tessel Boerma:** Investigation, Methodology, Writing – original draft. **Britt Hakvoort:** Investigation, Data curation, Writing – review & editing. **Elma Blom:** Investigation, Methodology, Writing – review & editing. **Madelon van den Boer:** Investigation,

Methodology, Writing – original draft.

Declaration of competing interest

None.

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