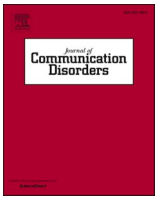
Journal of Communication Disorders 93 (2021) 106126

Contents lists available at ScienceDirect

Journal of Communication Disorders

journal homepage: www.elsevier.com/locate/jcomdis



Language profiles of Welsh-English bilingual children with Down syndrome

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ARTICLE INFO

Keywords:
Bilingualism
multilingualism
Down syndrome
developmental disorders
bilingual advantage
bilingual profiles

ABSTRACT

Purpose: Given that children with Down syndrome (DS) have language learning difficulties, concerns have been raised about the capacity of these children to acquire two (or more) languages. This research examines the language profiles of bilingual children with DS and typically developing (TD) children in comparison to monolinguals, with a view towards identifying the factors associated with language abilities within these populations.

Method: Four groups of children were recruited: Welsh-English bilinguals with DS (n=10), English monolinguals with DS (n=10), TD Welsh-English bilinguals (n=10) and TD English monolinguals (n=10). Children were individually matched on nonverbal cognitive ability (NVCA) to each child in the bilingual DS group and the four groups were matched on socioeconomic status and gender. Bilinguals were matched on current and lifetime exposure to Welsh and age of first exposure to their L2. Within DS and TD groups, chronological age was statistically controlled for. Language abilities were assessed via standardised assessments and specially designed tasks. Bilinguals were assessed in both of their languages.

Results: Results show no effect of language status on measures of expressive and receptive language abilities or phonological awareness. Language impairments were evident for both DS groups, particularly for expressive morphosyntax. Welsh receptive vocabulary scores of the bilinguals with DS were comparable to the TD bilinguals. Working memory, phonological awareness and chronological age were the strongest predictors of receptive language outcomes in both DS groups, explaining 90% of the variability.

Conclusions: In conclusion, we report no adverse outcomes on language development for bilinguals with DS. To our knowledge, this is the first group study of bilingualism in children with DS within the UK. Findings align with and add to the growing body of literature that reports that bilingualism does not negatively impact the language development of children with developmental disabilities. Clinical and educational implications are discussed.

1. Introduction

Bilingualism is an important feature of increasingly multicultural societies with the number of bilingual and multilingual individuals worldwide being higher than monolinguals (Marian & Shook, 2012). Identifying the impact that bilingualism has on cognitive and linguistic development becomes progressively more relevant. Bilingualism often plays an essential role within families

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https://doi.org/10.1016/j.jcomdis.2021.106126
Received 8 August 2020; Received in revised form 17 April 2021; Accepted 18 May 2021
Available online 1 June 2021

and the decision, or in many cases, the necessity of two languages (Bialystok & Barac, 2012; De Houwer, 1999) is important for family language transmission, particularly in minority language contexts. Current literature in the field of bilingualism within typically developing (TD) populations is constantly expanding, with growing support on the whole for bilingualism. Emerging literature also documents a bilingual advantage in areas such as phonological development (Tamburelli, Sanoudaki, Jones, & Sowinska, 2015), metalinguistic awareness (Adesope et al., 2010) and executive functioning (Bialystok, 2015) although conflicting findings have been reported (Paap & Greenberg, 2013).

Research to date suggests that bilingualism does not cause further language impairments in children with a developmental language disorder (Paradis, 2010; Paradis et al., 2003) or with autism spectrum disorder (ASD; Drysdale et al., 2015; Valicenti-McDermott et al., 2013). However, limited information is currently available regarding bilingual outcomes for children with Down Syndrome (DS). Linguistic settings that support and provide natural platforms to bilingualism, such as that in Wales, where two languages hold an official language status, provide an opportune environment to research bilingualism.

1.1. Bilingual language development in DS

To our knowledge, only one empirical group study to date has examined the language profiles of bilingual children with DS (Kay-Raining Bird, Cleave, Trudeau, Thordardottir, Sutton, Thorpe, et al., 2005). Kay-Raining Bird and colleagues recruited 22 children with DS (8 bilinguals, 14 monolinguals) alongside 29 TD children (11 bilingual, 18 monolinguals) who were matched by group on their developmental level. Children were assessed on standardised language assessments and language samples were obtained. Children with DS were aged between 2;7 and 11;5, with a mean age of 6;1 for the monolinguals and 7;1 for the bilinguals. Children were reported to have developmental ages between 1;8 up to 3;11 (mean = 2;7 for monolinguals and 2;11 for the bilinguals). The majority of bilinguals were English dominant according to parent report and standardised testing. The bilinguals with DS had varying second language abilities in French (n = 7) and Cree (n = 1).

Authors report that typical language profiles for the DS groups were found (i.e. specific challenges with expressive language and expressive morphosyntax). No detrimental impact on language abilities was reported for the bilinguals with DS in terms of receptive and expressive language or for mean length of utterance (MLU) in the children's L1 (English) in comparison to the monolinguals with DS. The authors stipulate that the results should be interpreted with caution due to the large variability in second language abilities within groups. Additionally, the authors suggest that individual differences should be examined further in order to fully understand and explain the range in abilities, and they call for further research in order to substantiate these findings.

Earlier research, employing case study designs, also provides evidence of the capacity of those with DS to become bilingual, including across modalities in a report on twins using British Sign Language and English (Woll & Grove, 1996). A successfully trilingual adult with DS has been reported in the literature with varying abilities in Italian, French & English (Vallar & Papagno, 1993). Furthermore, Cleave and colleagues (2014) conducted a study with bilinguals and monolinguals with DS in comparison to developmentally matched TD children to identify how these groups used syntactic information to acquire novel words in a comprehension task. As anticipated, the TD groups outperformed the DS groups, given that those with DS often display deficits in fast-mapping abilities, even when compared to developmentally matched TD children. The two groups of children with DS performed comparably. This research provides evidence that bilinguals with DS are not disadvantaged in their morphosyntactic abilities specifically compared to monolinguals with DS. No evidence of a bilingual advantage was detected, as the authors had predicted based on prior research showing that bilingual children more readily accept more than one label for an item on fast mapping tasks compared to TD children (Wilkinson & Mazzitelli, 2003).

Longitudinal parental reports have also been utilised to indirectly assess lexical development in 18 French-English bilinguals with DS (Trudeau et al., 2011). Substantial variability on second language performance was found based on initial and follow-up testing reports. It was again suggested that the development of a second language did not hinder the development of the first language. A further study investigated bilingualism in children with DS, with the aim of identifying if second language exposure impacted cognitive functioning (Edgin et al., 2011). This research did not explore linguistic outcomes, however, bilingual children with DS were comparable to monolinguals with DS on a number of neuropsychological assessments.

A further study of bilingualism in children with DS was conducted by Burgoyne et al. (2016). This was a case study of a sequential bilingual child with DS who was assessed on literacy skills and linguistic abilities in English and Russian in comparison to monolinguals with DS alongside TD controls. The authors describe the case study participant as being proficient in both her languages, with an advantage in favour of the language of instruction (English). This study demonstrates that bilingualism did not hinder the language and literacy development of the case study participant in English or Russian.

Finally, one recent multiple case study investigation explored the language profiles of four bilingually exposed children with a dual diagnosis of both DS and ASD (Ward & Sanoudaki, 2020). This research sought to document the bilingual capacities of children with significant cognitive and linguistic impairments who had been exposed to two languages compared to three control groups. Although variability was observed in the degree of impairments found, children with both DS and ASD were developing language abilities in accordance with the degree of exposure to each language. After considering non-verbal cognitive abilities, children dually diagnosed displayed similar language profiles to bilingual and monolingual children with DS. Although caution is warranted due to the small case study nature of the study, this research provides a preliminary insight into the bilingual capabilities of children dually diagnosed with both DS and ASD.

Although the number of studies in the field of bilingualism and DS is increasing, there is still a considerable lack of evidence within this population, especially in comparison to the breadth of available information on bilingualism within other DDs. Consequently, there remains an absence of information available to families and practitioners such as speech and language therapists faced with

questions surrounding bilingual capacities within DS specifically. This study aims to increase understanding of bilingualism in DS specifically by examining the language abilities in this population.

When appropriate matching paradigms are employed, converging evidence in support of bilingualism within various DDs is universally reported. Bilinguals with DDs who have language impairments are not found to experience additional difficulties or delays as a result of having been exposed to a second or third language (Kay-Raining Bird, Genesee, & Verhoeven, 2016). Of significance is the fact that no single piece of research has reported any negative impact of bilingualism for those with a DD.

In conflict with this evidence, the advice that practitioners have provided to families who have a child with a DD regarding bilingual exposure does not always coincide with research findings to date. Several reports suggest that parents of a child with a DD have been advised to restrict input to that of the community language; this includes parents who might have very limited abilities in that language (Kay-Raining Bird, Lamond, & Holden, 2012; Kremer-Sadlik, 2005). Although recent research suggests that guidance is starting to align with current evidence (Marinova-Todd, Colozzo, Mirenda, Stahl, Kay-Raining Bird, Parkington et al., 2016), it is still unclear if this is the case for children with more significant language impairments and whether this is true across all settings. Recent guidelines have also been introduced which specify that advising families to avoid second language exposure does not represent best practice (Royal College of Speech and Language & Therapists, 2019).

Poorer social outcomes may be found if families employ a forced monolingualism approach which has been highlighted by the Royal College of Speech and Language Therapists (Royal College of Speech and Language Therapists 2019). Recent research examining the bilingual experiences of children with ASD in Wales reported that those attending Welsh-medium schools felt more socially active in classrooms (Howard, Katsos & Gibson, 2019). This suggests that including children with ASD in Welsh-medium mainstream schools offers a positive experience and has a positive impact on social development. Although further research is needed to examine if this positive impact on social development is found for children with DS, it is possible that including children with DS in bilingual educational settings could have a positive impact on social development.

1.2. Phonological awareness in monolingual and bilingual children

Research suggests that TD bilingual children show advantages over monolingual children for elements of cognitive development, including executive function (Carlson & Meltzoff, 2008), executive control (Bialystok & Barac, 2012) and phonological awareness (Campbell & Sais, 1995) Bialystok et al., 2003; Chen et al., 2004; Canbay, 2011). This may be due to the two linguistic systems interacting and influencing each other, leading to accelerated development in some circumstances (for recent reviews, see Branum-Martin et al. 2012; Kuo et al. 2016). For example, a positive effect of bilingualism was reported by Campbell & Sais (1995) in young English-Italian bilingual children, whereby bilinguals outperformed English monolinguals on tasks assessing syllable deletion and phonemic identification. It was proposed that as the children were also learning Italian, which has a more regular syllable structure than English, this subsequently facilitated the development of phonological awareness among the bilingual children.

Additionally, the orthographic transparency of the languages being acquired has been reported to influence the development of phonological awareness (Cossu, Shankweiler, Liberman, Katz, & Tola, 1988; Goswami, Porpodas, & Wheelwright, 1997; Öney & Durgunoğlu, 1997). Languages that have a closer grapheme to phoneme correspondence have been reported to enhance the development of phonological awareness, and this has been reported in the Welsh language context by Spencer and Hanley (2003; see also Spencer 2000). The children acquiring Welsh had superior performance compared to the children learning English on tasks assessing phoneme awareness. It was suggested that this was due to Welsh being an orthographically transparent language whereas English is not.

In contrast to the potential beneficial effect of bilingualism on phonological awareness, monolingual children with DS show specific weaknesses in both identifying and manipulating various units of speech sounds (Cossu, Rossini & Marshall, 1993; Fletcher & Buckley 2002; Næss et al. 2015; Næss 2016). Phonological awareness has a crucial role in reading and spelling development for TD children ((Carnine, Silbert, Kame'enui, & Tarver, 2004); Melby-Lervåg, Lyster, & Hulme, 2012) and children with DS (Fletcher & Buckley, 2002), as well as being related to expressive language abilities (Newman et al., 2006). To date, no research has been conducted on the development of phonological awareness in multilingual children with DS. In an early case study of a 23-year old trilingual adult with DS, it was reported that the participant displayed higher abilities on phonological awareness than would be expected (Vallar & Papagno, 1993). Given the difficulties that are observed with phonological awareness in children with DS and the reported bilingual advantages for this ability, a further aim of this research will be to examine phonological awareness in bilingual children with DS.

1.3. Predictors of language outcomes in bilinguals

Quantity, quality and timing of exposure are three of the important influences on bilingual language development that have been identified in TD children (Hammer et al., 2012; Thordardottir, 2017). In considering bilingualism, questions are often raised as to how much exposure is adequate to ensure development in both languages. Numerous studies have now investigated the role of language input in TD children and these studies generally report that vocabulary sizes are closely associated with the quantity of input in a bilingual's two languages (Gathercole & Thomas, 2009). Researchers report that the current amount of exposure or the recency of exposure is a stronger predictor of language ability than exposure over the lifetime (Cohen, 2016; Thordardottir, 2017).

Parental socioeconomic status (SES) has also been highlighted as playing a significant role in language outcomes for TD children (Biemiller & Slonim, 2001; Hart & Risley, 1995; Pungello et al., 2009). For example, Pungello and colleagues assessed the language abilities of infants at four time points and found that SES significantly predicted language outcomes. Research investigating the influence of SES on language outcomes for children with DS, albeit limited, also suggests that high SES leads to an enhanced

developmental trajectory of language (Arango et al., 2018). As a result, it is essential to include this variable in the present study when determining the factors that influence language outcomes in bilingual populations with DS.

The role of input in bilingual children with DDs has been much less extensively explored. Hambly & Fombonne (2014) investigated the role of input on expressive language abilities in bilingual children with ASD. Although a large proportion were non-verbal at the time of their study (10 out of 33), results suggested that current exposure in the children's dominant language accounted for above 60% of expressive vocabulary scores, while lifetime exposure did not predict expressive vocabulary sizes. This provides some evidence that current exposure plays a significant role for both TD bilinguals and bilinguals with ASD. Preliminary evidence has been reported in a study of four bilingual children with DS (Feltmate & Kay-Raining Bird, 2008). In these French-English bilinguals, no consistent effect of language status was found for expressive vocabulary scores (i.e. bilinguals performed comparably to monolinguals). However, the variability observed in English compared to French language ability was accounted for on measures of current language input. This suggests that the amount of current input influences the language abilities of bilinguals with DS as well, although caution is warranted due to the very small sample size. The role of language input and SES will be explored further in the current study.

In researching bilingualism and the role of current and lifetime exposure, it is essential to assess both languages of a bilingual speaker, although often only the dominant language is assessed or studies only rely on parent report measures as opposed to objectively assessing language abilities. Many further predictor variables should be considered in relation to language outcomes in bilingual and monolingual children. These include the role of non-verbal cognitive ability (NVCA), chronological age (CA) and working memory (WM). The role of these variables is potentially more complex and multifaceted when it comes to children with a DD, and WM is known to be specifically impaired in children with DS (Jarrold & Baddeley, 2001). To date, only limited information is available concerning the role of these factors in bilinguals with ASD, and almost no information is currently available regarding bilinguals with DS. Given this lacuna, the current research will address the importance of SES, NVMA, CA and WM on language outcomes in bilingual children with DS. As those with DS have a specific profile of strengths and weaknesses in their development, understanding how these factors play a role in bilingual language acquisition will result in a more comprehensive understanding of the underlying mechanisms associated with bilingual exposure in those with DS.

1.4. The current study

Limited information is currently available concerning the capacity of children with DS to acquire two languages. Furthermore, the majority of information concerning this population has predominantly explored French-English bilinguals where the dominant language has a high language status. Studies to date often have overlapping samples whereby the same bilingual participants with DS have been included in multiple studies. Additionally, there is currently only one empirical group study addressing expressive and receptive language abilities in bilinguals with DS. The aim of the present research is to examine the language abilities of Welsh-English bilingual children with DS in comparison to developmentally matched monolinguals with DS alongside similarly matched TD bilinguals and monolinguals. If bilingualism exacerbates the linguistic delays and impairments observed in children with DS, it is plausible that these effects would be most evident in aspects that are already compromised in those with DS, including expressive morphosyntax, while advantages in phonological awareness previously reported in bilingual TD children may be found in bilingual children with DS. These are issues of growing clinical relevance and importance due to the increase in multilingual societies and the drive towards inclusivity for those with a DD. More specifically, we focus on examining the following research questions:

I How does performance on tests of language compare and contrast between monolingual and bilingual children with Down syndrome?
II How does performance on tests of language compare and contrast between bilingual children with Down syndrome and typically developing bilingual children?
III Do children with Down syndrome show an advantage in phonological awareness?
IV What is the role of age, socioeconomic status, working memory, non-verbal cognitive abilities and the amount of language exposure on the language abilities of children with Down syndrome?

2. Method

Full ethical approval was obtained from the University departmental ethical review board prior to data collection. Informed consent was provided by both parents/caregivers and schools. Careful deliberations were given to ethical considerations due to the target sample. Testing took place in the homes and schools of the children, depending on the convenience and suitability of these environments. Anonymous ID numbers were assigned to each participant and used throughout data collection and collation. Data was stored securely both as hard copies and electronically in line with general data protection regulations.

2.1. Participants

An initial cohort of 77 children were recruited for inclusion for this research specifically and participated in the language assessment sessions. Children with DS were aged between 5;5-13;9. This enabled a sample whereby children had enough receptive and productive language abilities but were still in the process of acquiring language. Parents all reported that their child had a diagnosis of DS. No parent specified that their child had mosaic or translocation subtypes of DS. Children were included if they had no more than mild hearing loss as determined by parental report of hearing status. This sample would subsequently be representative of those with

DS who frequently have mild or corrected hearing loss. Typically developing children were recruited alongside children with DS as to enable a comparison between the profile of bilingual children with DS and profiles of TD children. The TD children were aged between 3;0-7;10-years-old as it was anticipated that this age range would result in a comparable group of TD children in terms of developmental ability. Inclusion criteria stipulated that the TD children should not have any known or suspected language impairment or developmental disorder.

Within this sample, 14 bilingual children with DS were identified who met the initial inclusion criteria (i.e. within the specified age range, bilingual status and diagnosis). Four of these children were removed from the present sample as they had an additional diagnosis of ASD. The inclusion criteria stipulated that children with dual DS and ASD diagnosis could not be included in the current study as these children often display unique cognitive and linguistic phenotypes compared to children with a singular DS diagnosis. In addition, there is usually greater variability in the degree of intellectual disability and language abilities. For information on these four case study participants dually diagnosed with DS and ASD, see (Ward & Sanoudaki, 2020)-

Ten children remained in the target group of bilingual children with DS (DSB) after excluding the participants who did not meet the inclusion criteria stipulated above. The participants in the DSB group were individually matched by ± 2 non-verbal cognitive raw score points (as measured by the non-verbal matrices subtest of the KBIT-II; Kaufman & Kaufman, 2004) to one child in each of the other three groups; Down syndrome monolingual (DSM), typically developing bilingual (TDB), and typically developing monolingual (TDM). The non-verbal measure only was employed as verbal cognitive assessments would not be appropriate given the aim of the study to assess language abilities. One measure of nonverbal mental age was used as not to increase the time required to complete the comprehensive battery of assessments administered.

Consequent to this stringent matching process, this left a total sample of 40 children, with 10 participants in each of the four groups. Analyses confirmed that the groups were also matched overall for NVCA ($p = .972$). A summary of the group characteristics is presented in Table 1.

Participants with DS were recruited through contact with two organisations that support children with DS and intellectual disabilities. The majority of children with DS were attending mainstream schools (n = 13), with others attending special educational needs schools (n = 3) or within specialist units in mainstream schools (n = 2). A further two parents reported that their child attended both a special educational needs and a mainstream school on various days. Typically developing children were primarily recruited by contacting local schools and nurseries with children of the specified age range.

Bilingual status was determined by measures of current and lifetime exposure to Welsh and English which were obtained via parent report (with a cut off exposure criteria being at least 20% for inclusion in bilingual groups). Parents were asked to report the percentage of time their child was currently exposed to each language, the percentage of lifetime exposure to each language and the percentage of time that the child responded in each language. Further information regarding home language use, age of first exposure to each language, the consistency of exposure and any gaps in exposure was obtained. As English is the majority community language in Wales, all children received substantial input in English, with bilinguals also receiving exposure to Welsh at home, school or both.

Statistical analyses confirmed the group status of bilinguals and monolinguals whereby both bilingual groups received significantly more current ($p < .001$) and lifetime ($p < .001$) input in Welsh compared to the monolinguals. Bilingual groups were also statistically matched on the age of exposure to a second language ($p = .983$). It should be noted that small amounts of Welsh is taught in all schools in Wales due to legislation and protection of the language which explains the reporting of limited exposure to a second language for the monolingual groups. Some parents in the DSM group (n = 5) reported no additional language input as some children had a statement that disapplied them from Welsh language lessons. All children classified as bilingual were considered simultaneous bilinguals as they received exposure to Welsh and English from birth or before the age of 2. Bilinguals ranged in the amount of Welsh input with half either dominant in the minority language (Welsh; 40%) or balanced bilinguals (10%). Language dominance was determined by the language that the participant had received the most lifetime and current input to (according to parent report).

As the participants in each group were individually matched on non-verbal cognitive ability (NVCA), both of the TD groups were significantly younger ($p < .001$) than the DS groups. The two groups of children with DS were statistically matched on CA ($p = .890$) as were the two groups of TD children ($p = .907$). Group matching for all four groups was achieved for parental socioeconomic status (SES; $p = .790$). Parental SES was calculated as a composite score of parental occupation and education level. Composite scores for SES

Table 1
Group characteristics of the four groups.

	Down Syndrome Bilingual (n=10)	Monolingual (n=10)	Typically Developing Bilingual (n=10)	Monolingual (n=10)
Age in months [a]	114.2 (37.7)	112 (31.9)	51.6 (17.4)	50.7 (16.5)
Non-verbal cognitive ability	9.6 (6.5)	10.7 (6.3)	10 (6.2)	9.5 (6.0)
SES	10.9 (1.7)	9.9 (2.6)	10.8 (2.0)	10.6 (3.1)
Current Welsh exposure in % [b]	48.1 (26.28)	5.01 (9.42)	57 (21.63)	12.8 (14.88)
Lifetime Welsh exposure in % [b]	50 (24.04)	2.79 (4.40)	45.8 (24.12)	8.3 (9.89)
Working memory	2.8 (0.79)	2.9 (0.88)	3.1 (0.88)	2.9 (0.88)

Note: Mean scores are reported with standard deviations in parenthesis. Non-verbal cognitive ability represent raw scores on the non-verbal matrices subtest of the KBIT-II (Kaufman & Kaufman, 2004). Socioeconomic status (SES) was obtained via parent report in terms of parental education and occupation (scale from 2-14). [a] Indicates a between-group effect of syndrome with $p < .05$. [b] Indicates a between-group effect of language status with $p < .05$.

were calculated by combining likert scale scores on these measures (from 1 - 7) that were obtained via the parental report questionnaire. The combined scale for SES ranged between 2 - 14 (mean = 10.55; SD = 2.35). Analyses of the children's cognitive profiles showed that none of the TD children displayed any evidence of an intellectual disability. This was calculated by converting raw scores on the KBIT-II to intelligence quotients. The two groups of children with DS were also comparable on the degree of cognitive impairments with 20% of each group displaying severe learning difficulties and the remaining 80% moderate difficulties. Gender distribution was comparable between the four groups with no significant differences ($p = .662$).

2.2. Procedure and Assessments

Children were assessed on their cognitive and linguistic abilities in one-to-one sessions with the first author which included standardized assessments and experimental tasks. Assessments were completed in a pre-defined order as presented in Table 2. Testing took place in English first for all participants to allow for direct comparison of the English measures between bilingual and monolingual groups. Any apparent practice effects (due to bilinguals being assessed in both English and Welsh) would then be exclusively restricted to the Welsh assessments for both bilingual groups.

The bilingual groups were assessed on their Welsh language abilities in a separate session which was on a different day where possible, which was for all participants besides two children for both the DSB group and the TDB group. During each session, only the language of testing was used in order to minimize code-switching and to place the children in a 'monolingual mode' to the extent that this was possible with a bilingual experimenter (Grosjean, 2012; Grosjean, 1989). Forward digit span measures were employed as an assessment of WM with an increasing length of digits from two upwards. Parents completed a background questionnaire with three sections: information about their child, language background and information about themselves.

2.2.1. English Language Assessments

In order to assess language abilities in English, the seven main subtests of the Clinical Evaluation of Language Fundamentals-Preschool Second Edition (CELF-P-2; Semel, Wiig, & Secord, 1998) were administered, which enabled measures of core, expressive and receptive skills. The preschool edition of the CELF was utilised, as it is suitable for children between the ages of 3 to 7-years-old and it was anticipated that the developmental ages of the children with DS were likely to fall within this age bracket. All analyses from the CELF-P-2 were conducted using standardised z-scores converted from combined raw scores, due to participants falling outside of the age range for reported standardised scores from the assessment manual. This allowed direct comparison between the different components of this measure: receptive, expressive and core language. Standardised z-scores were calculated for the combined four group sample. Core language comprised of the Sentence Structure, Word Structure and Expressive Vocabulary subtests, Receptive Language by using the Sentence Structure, Concepts and Following Directions and the Basic Concepts Subtest. Expressive Language included the Word Structure, Expressive Vocabulary and the Recalling Sentences subtests.

2.2.2. Phonological Awareness Assessments

Specially designed phonological awareness (PA) tasks were administered, consisting of six tasks, each with ten test items and two practice items. Two tasks, one receptive and one productive were designed for each level of PA, rhyme, syllable and phoneme. In order to account for the visual processing strengths and memory impairments in children with DS, pictorial stimuli were provided alongside verbal stimuli when possible in line with Kennedy & Flynn's (2003) recommendations of assessing PA in those with DS.

Phonological awareness tasks were designed according to previous methods used in researching PA in DS (Boudreau, 2002; Cupples & Iacono, 2000; Kennedy & Flynn, 2003; Verucci et al., 2006). For all tasks, encouragement was given for selecting the correct item during the two practice items only. If the incorrect item was selected during the practice items, the correct response was taught to model the appropriate response. The first task was a rhyme identification task which measured the children's ability to identify rhyming word pairs in monosyllabic words. Testing involved the presentation of a target item, followed by a choice of three items, one

Table 2
Assessment list and order of administration

Monolingual and bilingual	
Cognitive assessment	KBIT-II: Non-verbal matrices subtest
Working memory assessment	Forward digit span verbal recall
English language assessment	CELF-P-2: Sentence structure, Word structure, Expressive vocabulary, Concepts and following directions, Recalling sentences, Basic concepts and Word classes subtests
Phonological awareness assessment	Specially designed phonological awareness tasks – Rhyme Identification, Rhyme Generation, Syllable Segmentation, Syllable Deletion, Initial Phoneme Matching, Phoneme Segmenting
Parent/guardian questionnaire	Background questionnaire relating to language history and enabled categorization into appropriate groups
Bilingual only	
Working memory assessment	Forward digit span verbal recall in Welsh
Phonological awareness assessment	Specially designed phonological awareness tasks in Welsh – Rhyme Identification, Rhyme Generation, Syllable Segmentation, Syllable Deletion, Initial Phoneme Matching, Phoneme Segmenting
Welsh language assessment	Prawf Geirfa – Receptive vocabulary assessment, first third administered

Note: KBIT-II: Kaufman's Brief Intelligence Test-Second Edition (Kaufman & Kaufman, 2004), CELF-P-2: Clinical Evaluation of Language Fundamentals-Preschool Second Edition (Semel, Wiig, & Secord, 1998).

of which rhymed with the target word; children were asked which item ended with the same sound as the target item. For example, the children were asked which item ended with the same sound as 'bat', with the options of 'man,' 'hat' and 'tie.' The next task was a rhyme generation task whereby children were presented with a target item and asked if they could think of a word that ended in the same sound. The examiner modelled an appropriate matching word if the child did not provide a response during the initial practice items.

Syllable-level tasks followed the rhyme-level tasks with a syllable segmentation task as a non-verbal measure of syllable identification. Children were presented with a word between 2-4 syllables and were asked to clap or tap the sounds that they could hear in the words. Following this, the syllable deletion task assessed the ability to delete the final or initial syllable. For example, the word 'doctor' (/ˈdɒktə/) would become 'doc' (/ˈdɒk/) in the final syllable deletion task. The phoneme-level tasks were presented last and began with an initial phoneme matching task, which was similar to the rhyme identification task with one target item followed by three possible items. Children were asked to identify which of the items started with the same sound as the target item. For example, the children were asked which item began with the same sound as 'pig' (/pɪg/), with the options of 'sea' (/siː/), 'pot' (/pɒt/) and 'crow' (/krəʊ/). The final task was a phoneme segmenting task where children were asked to say all the individual sounds in words. Again, correct responses were modelled during the practice items. Scores for the PA measures were calculated by combining scores from each PA level (i.e. rhyme, syllable and phoneme), and overall PA was calculated by combining raw scores for all six tasks.

2.2.3. Welsh Language Assessments

A separate session assessed Welsh language abilities for the bilingual groups in order to capture their abilities in both languages. A forward digit span was firstly administered which was equivalent to the English digit span task. The first third of the Prawf Geirfa Cymraeg: Fersiwn 7-11 (The Welsh Vocabulary Test: Version 7-11; Gathercole & Thomas, 2007) was utilised, which comprised of 37 items to assess Welsh receptive vocabulary. Raw scores were used for the Prawf Geirfa as participants were outside of the age range for standardised scores. This subset was selected as the assessment becomes progressively harder as the assessment continues with no discontinuation rule. As the children were below the target age range for this assessment, the subset selected was more appropriate for the target population. Phonological awareness tasks with the same design as that of the English tasks described above were also administered in Welsh. The English and Welsh tasks were designed in the same way with the aim being to provide measures that were equally difficult, so as to provide an equivalent measure of PA in both English and Welsh.

2.3. Data Analysis

Between and within-group analyses included analyses of variance (ANOVAs), multivariate analyses of variance (MANOVAs) and general linear models. Any significant effects were followed up using post-hoc comparisons with Bonferroni corrections or simple main effects analyses where appropriate. To examine the contribution of age, working memory, non-verbal cognitive abilities and L2 exposure on language abilities, a series of linear mixed-effects regression models were used using the enter method.

3. Results

3.1. Core, receptive and expressive language

To identify and compare the core, receptive and expressive language abilities of bilinguals with DS compared to the three control groups, a series of ANOVAs were conducted for each component for the English language assessments. Language status (bilingual vs monolingual) and diagnosis (DS vs TD) were used as between-group variables. Standardised z-scores for each of these measures are reported in Table 3. No significant differences were found between males and females for core t (38) =.025, p =.980, receptive t (38) =.105, p =.917 or expressive language t (38) =.214, p =.831. As a result, no further analyses were conducted for gender.

Between-group ANOVAs for English core, receptive and expressive language revealed an effect of diagnosis for expressive language

Table 3
Mean standardised z-scores on CELF-P-2 subtests across groups

CELF-P-2 Component	Component Sub-tests	Down Syndrome		Typically Developing	
		Bilingual	Monolingual	Bilingual	Monolingual
Core Language	*SS*	-0.178	-0.314	0.382	0.110
	WS	-0.524	-0.282	0.379	0.110
	EV	-0.383	-0.012	0.115	0.281
	Overall	**-0.412**	**-0.113**	**0.253**	**0.272**
Receptive Language	*SS*	-0.178	-0.314	0.382	0.110
	C&FD	-0.414	-0.050	0.441	0.023
	BC	-0.347	0.091	0.164	0.091
	Overall	**-0.360**	**-0.127**	**0.442**	**0.045**
Expressive Language	*WS*	-0.524	-0.282	0.379	0.110
	EV	-0.383	-0.012	0.115	0.281
	RS	-0.544	-0.466	0.709	0.301
	Overall	**-0.412**	**-0.113**	**0.253**	**0.272**

Note: SS = Sentence Structure; WS = Word Structure; EV = Expressive Vocabulary; C&FD = Concepts and Following Directions; RS = Recalling Sentences; BC = Basic Concepts.

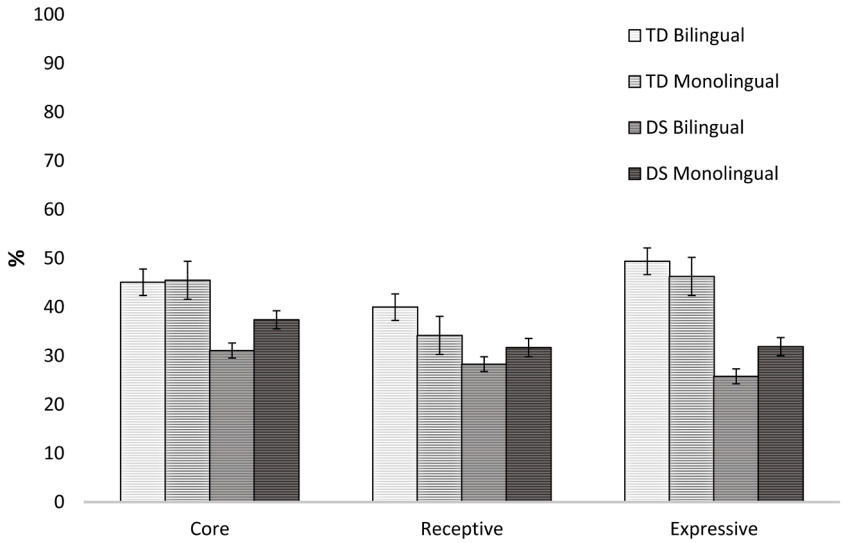

Fig. 1. Mean scores on core, receptive and expressive language in English as measured by the CELF-P-2 distributed by diagnosis and language status.

F (1, 36) = 6.666, p = .014, η_p^2= .152. No effect of diagnosis was found for core language F (1, 36) = 2.777, p = .104, η_p^2= .072, and receptive language F (1, 36) = 2.397, p = .130, η_p^2= .062. No effect of language status was found for core language F (1, 36) = 0.255, p = .616, η_p^2= .007, receptive language F (1, 36) = 0.068, p = .795, η_p^2= .002 or expressive language F (1, 36) = 0.042, p = .840, η_p^2= .001. Interactions were not significant for any language component. Given the significant effect of diagnosis on expressive language, further analyses were conducted to identify which sub-tests showed significant differences between DS and TD groups. These analyses showed that the DS groups scored significantly lower than the TD groups for the Word Structure F (1, 36) = 7.280, p = .011, η_p^2= .168 and Recalling Sentences F (1, 36) = 13.132, p < .001, η_p^2= .267 subtests, but not the Sentence Structure F (1, 36) = 2.423, p = .128, η_p^2= .063, Expressive Vocabulary F (1, 36) = 1.535 p = .223, η_p^2= .041, Basic Concepts F (1, 36) = 630, p = .432, η_p^2= .017 or Concepts and Following Directions F (1, 36) = 2.191, p = .147, η_p^2= .057 subtests. The effect sizes were large for the recalling sentences and word structure sub-tests. No effect of language status was found for any sub-test nor were there any significant interactions. Fig. 1 presents a summary of core, receptive and expressive scores across the four groups.

3.2. Bilingual groups

Separate analyses were conducted to compare the language abilities of the two bilingual groups (research question 2). A general linear model found no significant effect of diagnosis for receptive language scores in Welsh between TDB (M = 21.6, SD = 8.91) and DSB (M = 22.8 SD = 6.76) groups with F (1, 18) = .115, p =.738, η_p^2= .006. A series of general linear models revealed an effect of diagnosis for the English language measures whereby the TDB group outperformed the DSB group for the Recalling Sentences subtest, again with a large effect size F (1, 18) = 8.746, p = .008, η_p^2= .327. No effect of diagnosis was found for the remainder of the English language assessments (Word Structure F (1, 18) = 4.083, p = .056, η_p^2= .189; Sentence Structure F (1, 18) = 1.725, p = .206, η_p^2= .087; Expressive Vocabulary F (1, 18) = 1.252, p = .278, η_p^2= .065; Concepts and Following Directions F (1, 18) = 3.837, p = .066, η_p^2=

Table 4
Mean raw scores on English phonological awareness across groups.

Phonological Awareness Component	Component Sub-tasks	Down Syndrome		Typically Developing	
		Bilingual	Monolingual	Bilingual	Monolingual
Syllable	*SS*	6.6	6.0	6.9	4.4
	SD	0.2	1.0	3.1	2.0
	Overall	**6.8**	**7.0**	**10**	**6.4**
Rhyme	*RI*	4.6	5.7	4.9	4.9
	RG	0.4	0.6	0.6	1.4
	Overall	**5**	**6.3**	**5.5**	**6.3**
Phoneme	*PM*	5.9	5.6	6.7	4.4
	PS	4.1	3.4	3.4	2.7
	Overall	**10.0**	**9.0**	**10.1**	**7.1**
Phonological Awareness Total		**21.8**	**22.3**	**25.6**	**19.8**

Note: SS = Syllable Segmenting; SD = Syllable Deletion; RI = Rhyme Identification; RG = Rhyme Generation; PM = Initial Phoneme Matching; PS = Phoneme Segmenting.

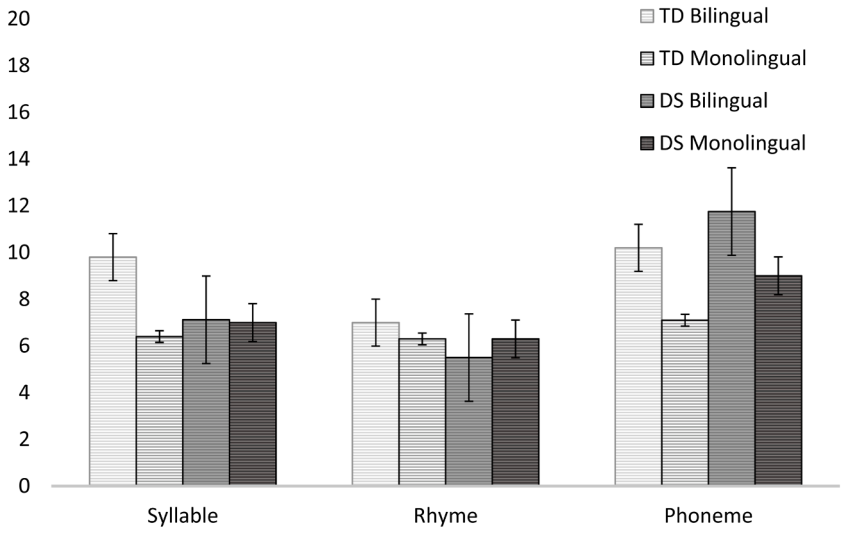

Fig. 2. Mean raw scores on phonological awareness assessments for rhyme, syllable and phoneme levels distributed by diagnosis and language status. *Note:* Maximum raw score for each condition is 20.

.176; Basic Concepts F (1, 18) = .959, p = .340, η_p^2= .051).

3.3. Phonological awareness and working memory

A summary of the results on the English PA assessments is presented in Table 4 for the three conditions (syllable, rhyme and phoneme) and the sub-tasks within each of these conditions.

No significant differences were found between males and females for overall PA with t (38)=.429, p = .670, therefore, no further analyses were conducted for gender.

A MANOVA was performed to compare performance on the PA conditions, with diagnosis and language status as between-group variables. No effect of diagnosis was found with F (3, 34) = 1.861, p = .155, η_p^2= .141. No effect of language status was found F (3, 34) = .610, p = .613, η_p^2= .051, nor was there a significant interaction between language status and diagnosis F (3, 34) = .472, p = .704, η_p^2= .040. Fig. 2 provides a summary of the performance across groups for syllable, rhyme and phoneme assessments.

Analyses of WM showed no effect of diagnosis F (1, 36) = .308, p = .582, η_p^2= .008. No effect of language status was found for WM, F (1, 36) = .034, p = .854, η_p^2= .001, nor was a significant interaction found F (1, 36) = .308, p = .582, η_p^2= .008.

Further comparisons were conducted between the two bilingual groups (DSB and TDB) using scores on the Welsh and English PA assessments. A three-way mixed-design ANOVA was conducted with diagnosis (DS, TD) as a between-group variable and PA condition (rhyme, syllable, phoneme) and language (Welsh PA, English PA) as within-group variables. An effect of PA condition was found F (2, 17) = 11.749, p < .001, η_p^2= .580. No effect of language was found F (1, 18) = 4.017, p = .060, η_p^2= .182, nor was a between-group effect found for diagnosis F (1, 18) = .235, p = .634, η_p^2= .013. No interactions were significant. Following the significant effect of PA condition, pairwise comparisons revealed that performance was lower on the rhyme condition compared to syllable (p = .023) and phoneme conditions (p < .001). No difference was detected between syllable and phoneme conditions (although this approached significance with p = .051).

A MANOVA was conducted to compare performance between the conditions (rhyme, syllable and phoneme) in English for all groups, which displayed an effect of condition F (2, 35) = 8.515, p = .001, η_p^2= .327. Main-effect analyses showed an effect of condition for the DS groups F (2, 17) = 6.874, p = .006, η_p^2= .447 but not the TD groups F (2, 17) = 3.203, p = .066, η_p^2= .274. Post-hoc comparisons were performed following the significant result for the DS groups, which found that phoneme scores were significantly higher than rhyme scores (p = .005). Given this significant effect for DS groups, follow-up analyses found that performance on the

Table 5
Standard beta coefficients for the English receptive language regression model.

Variable	Non-Standardized Coefficients		Standardized Coefficients	t	*p*
	B	SE B	β		
CA	-.065	.028	-.184	-.2375	.023
NVCA	1.062	.300	.438	3.537	.001
SES	.833	.445	.134	1.873	.070
WM	5.850	1.730	.332	3.381	.002
PA	.321	.136	.300	2.360	.024

Note: CA: Chronological Age, NVCA: Non-Verbal Cognitive Ability, SES: Socioeconomic status, WM: Working memory, PA: Phonological Awareness.

Table 6
Standard beta coefficients for the Welsh receptive language regression model.

Variable	Non-Standardized Coefficients		Standardized Coefficients	t	*p*
	B	SE B	β		
CA	.032	.013	.176	2.395	.031
SES	-.001	.340	.000	-.003	.997
PA	.396	.057	.679	6.933	.000
WE	.082	.027	.250	3.077	.008
WM	1.934	.862	.207	2.243	.042

Note: CA: Chronological Age, SES: Socioeconomic status, PA: Phonological Awareness, WE: Welsh Exposure, WM: Working memory.

rhyme generation and the syllable deletion tasks was significantly lower than all other PA tasks ($p < .005$). No significant difference was found between the rhyme generation and the syllable deletion tasks ($p = 1.000$). No significant interaction was found for PA condition and language status for any group.

3.4. Factors relating to language outcomes

In order to address the final research question, linear mixed-effects regression models were employed to examine the predictive role of language input, SES, CA, WM and NVCA on receptive language abilities. To avoid multicollinearity, current and lifetime exposure to English could not both be entered into the regression model as they were both highly correlated with each other ($r = .92$). As current exposure is reported to play more of a role in predicting language outcomes (Hambly & Fombonne, 2014), this variable was used in subsequent regression models. The model which accounted for the most amount of variance in considering all groups included CA, NVCA, English PA, WM and SES which explained a significant amount of variation on receptive language abilities in English $F(5,34) = 33.78$, $p < 0.001$, $R^2 = 0.832$. Within this model WM, CA, NVCA and English PA were all significant predictors of English receptive language abilities ($p < .05$). Current exposure to English and SES did not significantly increase the explained variance. Detailed information on standard beta coefficients is provided in Table 5. The variables that were significant predictors of English receptive abilities were then entered into separate models for both the DS and TD groups. All variables remained significant predictors for both populations $F(4,15) = 35.150$, $p < 0.001$, $R^2 = 0.904$, and $F(4,15) = 15.494$, $p < 0.001$, $R^2 = 0.805$ respectively. For DS groups, WM was the strongest significant predictor ($p = .001$), but for TD groups, NVCA was the strongest significant predictor ($p = .015$) of receptive English language outcomes.

For Welsh receptive language abilities, a significant amount of variance was also explained by WM, CA, Welsh PA and current exposure to Welsh $F(4,15) = 42.369$, $p < 0.001$, $R^2 = 0.919$ (for standard beta coefficients, see Table 6). All of these variables were significant predictors of Welsh receptive abilities ($p < .05$) and as with the English measures, SES did not increase explained variance. Current exposure to Welsh was a significant predictor of Welsh receptive vocabulary for both bilingual groups. Follow up Pearson's correlations found a significant correlation for Welsh receptive ability and Welsh lifetime exposure for the DSB participants ($r = .773$, $p = .016$) only but not for the TDB group ($r = .18$, $p = .619$).

4. Discussion

The purpose of this research was to examine the language profiles of bilingual children with DS in comparison to monolinguals with DS and developmentally matched TD controls. Given the difficulties in language acquisition documented in children with DS, the aim of this research was to examine how language profiles compare for monolingual children with DS who have received exposure to English compared to children with DS who have received exposure to both English and Welsh. Results of this research support previous findings with French-English bilinguals with DS (Kay-Raining Bird et al., 2005) which revealed that the bilinguals with DS did not show any evidence of further language delays or impairments on measures of receptive and expressive language. In the present study, we report no detrimental impact of bilingualism for any of the language measures undertaken which include PA, core, receptive, and expressive language. These findings align with previous research in that bilingualism does not appear to negatively impact language development for children with developmental disorders. In addition to strengthening previous findings, this research has extended these results to a different population as many of the children in the current study were dominant in the minority language (Welsh) or balanced bilinguals. The bilingual children in Kay-Raining Bird et al.'s study were dominant in English, according to parental reports and standardized testing, and in a bilingual setting where both English and French are widely spoken. In addition, we examined children slightly older than the children in Kay-Raining Bird and colleagues study. Therefore, this study has increased understanding of bilingual language abilities in individuals with DS in children who were at a later stage of language development.

4.1. What are the language abilities of bilingual children with Down syndrome compared to monolinguals with Down syndrome?

Arguably, the most important finding from this research is that the language abilities of the bilinguals with DS were comparable to those of the children with DS who were only exposed to English after carefully considering NVCA, CA and socioeconomic status. All language assessments conducted in English show that for measures of PA, expressive, receptive and core language ability, the bilingual groups performed comparably to that of the monolingual groups. Previous research suggests that parents of children with a DD such as

DS have been advised to restrict input to a single language, which in most cases is the majority community language (Marinova-Todd, Colozzo, Mirenda, Stahl, Kay-Raining Bird, Parkington et al., 2016). These recommendations are reported to have stemmed from the view that bilingualism may result in additional delays or impairments in language development. If these recommendations were correct, it would be expected that impairments would be most apparent in aspects of language which are already particularly compromised. As a result, the fact that no further deficits in expressive morphosyntax and phonological awareness were detected is a meaningful outcome. Given the crucial role of PA on later reading and spelling development in both TD and DS populations (Fletcher & Buckley, 2002), the finding that PA is comparable in bilinguals and monolinguals with DS has important implications on educational provisions which are discussed later.

Similar profiles of language were found for both DS groups, with both groups displaying higher receptive language abilities than expressive abilities. This profile is frequently reported in the literature on language development in children with DS (Roberts et al., 2007). For the PA measures, similar language profiles were again evident for both the DSB and DSM groups. Both groups had higher performance on the phoneme tasks compared to the syllable and rhyme conditions. Rhyme assessments appeared to be particularly challenging for both groups with the majority of children unable to produce rhyming word pairs. Previous research has documented specific difficulties within this domain for children with DS (Cardoso-Martins, Michalick & Pollo, 2002; Hulme et al., 2012; Næss, 2016) where assessments of rhyme identification were particularly lower than expected.

4.2. How does bilingual acquisition in children with Down syndrome compare to typical bilingual language acquisition?

In order to compare the language profiles of bilingual children with DS, typically developing bilingual children were recruited alongside the DSB group. In comparing the two bilingual groups, no differences were found for English core or receptive language abilities, however, the children in the DSB group performed significantly lower than the TDB group for expressive language abilities. This mirrors the findings for the monolingual children with DS, in that the children with DS displayed expressive language impairments compared to the TD groups, with large effect sizes. More specifically, results show that the children with DS had difficulties with the word structure and recalling sentences subtests. This was expected and coincides with previous research which reports marked difficulties with speech production and expressive morphosyntax (Andreou & Katsarou, 2013). Similar performance was found between the DSB and TDB groups for receptive vocabulary sizes in Welsh, as measured using a subset of the Prawf Geirfa (Gathercole and Thomas, 2007). It is important to note that receptive language is a relative strength for children with DS. As there are very limited Welsh language measures, this assessment was employed as it is the only validated Welsh language assessment currently available.

No differences were found for PA in Welsh overall, as well as for the three conditions: syllable, rhyme and phoneme. Analyses that account for PA abilities in both Welsh and English for the DSB and TDB groups for English and Welsh were employed, which revealed that both groups had comparable PA abilities in both of their languages. These results show that the bilinguals with DS had Welsh comprehension abilities and PA abilities in Welsh which were commensurate with younger TD Welsh-English bilingual children who were of the same developmental ability.

4.3. Is there evidence of a bilingual advantage on measures of phonological awareness in bilingual children with Down syndrome?

In terms of metalinguistic awareness, some studies report that bilingualism enhances the development of PA (Bialystok, Majumder & Martin, 2003; Verhoeven, 2007) as a result of increased explicit attention to the form of language as opposed to meaning resulting from input to two languages. Others have questioned what circumstances may confer a cognitive advantage for bilinguals, if any (for recent reviews, see de Bruin et al., 2015; Lehtonen et al., 2018; von Bastian et al., 2016). In the current study, no evidence of a bilingual advantage was found for either of the bilingual groups. Additionally, no effect of language status was found for WM as measured by a forward digit span task.

Researchers reporting on the executive functioning and metalinguistic abilities in Welsh-English bilingual children and adults specifically have similarly found no conclusive evidence for a bilingual advantage within this population (Gathercole et al., 2014). As a result, the authors suggest that the bilingual context in Wales may promote greater automaticity in linguistic processing between the two languages within fully fluent bilingual communities where the two languages are often used interchangeably. They suggest that it is possible that effortful monitoring, inhibiting and controlling is not required to the same extent in linguistic communities such as Wales. This suggestion may also partly explain the lack of a bilingual advantage for PA in the current study.

Alternatively, it may be the case that the developmental ages of the children were not adequate to lead to an advantage on PA as it has been suggested that these advantages only emerge in those with a CA above 4 years (Duncan et al., 2009). Our TD sample may have been too young both in developmental age and in CA for these benefits to be observed. Many of the children in the DS groups had developmental ages under four, which may explain why no bilingual advantage was detected for these groups. This would also explain the apparent discrepancy between our results and those of Spencer and Hanley (2003).

4.4. What is the role of age, socioeconomic status, working memory, non-verbal cognitive abilities and amount of language exposure in children with Down syndrome?

In order to ascertain some insight into the relatively high degree of within-group variability which is often observed in those with DS, several factors were considered in relation to receptive language abilities. These were current language input, CA, NVCA, parental socioeconomic status, PA and WM. For the DS and TD groups, significant predictors of English language comprehension abilities were WM, NVCA, CA and PA which explained 90% of the variation in the DS groups and 81% in the TD groups. The strongest predictor of

receptive language for the DS groups was WM. For the TD groups, NVCA had the largest impact. This may have some important clinical implications on the role of WM. This finding suggests that WM is the strongest contributor to language comprehension in this population, meaning that targeting both language and WM in therapy sessions may prove to be successful.

As reported elsewhere, NVCA seems to play less of a role in determining language outcomes in bilinguals with DS (Kay-Raining Bird et al., 2005) and monolinguals with DS (Abbeduto et al., 2003) in comparison to TD children. In addition, current exposure to English did not significantly increase the explained variance in language abilities. In contrast, the amount of lifetime input in Welsh was significantly related to Welsh receptive vocabulary scores for the bilingual DS group only. This suggests that receptive language abilities in children with DS are somewhat related to the amount of input. Previous research with TD children (Haman et al., 2017) and children with ASD (Gonzalez-Barrero & Nadig, 2018) have reported that in bilinguals, the amount of current input is predictive of language abilities. In researching those with DS specifically, Kay-Raining Bird and colleagues also did not find that duration of exposure to the L2 was predictive of language abilities in bilinguals with DS.

Similar findings to the current research are reported in the only study which examined the frequency of L2 exposure in bilinguals with DS in a parent report study (Trudeau et al., 2011). In their research, the amount of input to the majority language (English) was not related to language abilities. However, input to an L2 (simply defined as a language other than English as opposed to the second or weaker language necessarily) was related to vocabulary development. This finding may be due to the specific profile of receptive and expressive abilities found for individuals with DS. This provides some evidence that the amount of input plays a role in determining language abilities for those with DS. It is possible to consider the other factors which were included in the analyses. These factors may play more of a role in impacting language ability, for example, the age of first exposure or the duration of exposure may outweigh these effect. The variability within and between groups may explain why a relationship was found for Welsh input but not English, as for the bilingual groups, larger variation in exposure to Welsh and English was reported. Nevertheless, research employing longitudinal designs and more thorough assessments of language input and language use are needed to explore the relationship between input and language outcomes in this population further. Socioeconomic status as measured by parental education and occupation also did not significantly predict language abilities in either Welsh or English for TD and DS groups.

5. Summary

This research reports that bilinguals with DS perform comparably to monolinguals with DS on all aspects of language under study. Similar developmental profiles were found for both populations after considering chronological age, developmental ability, socioeconomic status and WM. This aligns with and extends previous findings which demonstrate that bilingualism does not negatively impact language development for children with a developmental disorder. Analyses successfully accounted for a large proportion of variability in receptive language abilities with WM, PA, chronological and developmental ability explaining 90% of the variance. The amount of current input in Welsh was related to Welsh receptive vocabulary scores but not for English, which is possibly due to the fact that Welsh is a minority language. Consequently, further research is required to explain the variability in language outcomes for bilinguals with DS and to explore further elements which may impact language acquisition for this population, for example, the role of early parent-child interactions and gesture usage.

5.1. Limitations and future directions

The first limitation to acknowledge is the relatively small sample size. Caution is warranted in interpreting the findings, particularly as the sample contained early bilinguals that were English-dominant or Welsh-dominant. Furthermore, consideration should be given to the fact that bilingual speakers are not a homogeneous population and a bilingual's consistency of exposure to each language may be dynamic and dependant on a number of factors. Although the sample size is small, this sample is in line with other studies that investigate bilingualism in these populations and is larger than some other studies in this field. The stringent matching procedure employed led to a rigorously designed sample of participants which considered a number of factors including developmental ability, chronological age, socioeconomic status, gender and exposure to a second language. Medium and large effect sizes were found which suggests that the sample sizes were adequate in justifying the findings and conclusions reported. Four children with DS and an additional diagnosis of ASD were excluded from this research, which also reduced the sample size and may reduce the generalisability of the findings. These participants are reported separately (see Ward & Sanoudaki, 2020) as children with this dual diagnosis specifically often display a unique linguistic phenotype.

A further limitation to consider is the lack of counterbalancing for the order of testing for the bilingual participants. As it was anticipated that there would be a small sample due to the nature of the target group (i.e. bilingual children with DS) and the specification that the participants had to be bilingual in English and Welsh, all participants were assessed in English first as to enable a direct comparison with the English monolingual participants. As a result, there is a possibility that there may have been practice effects for some of the Welsh assessments due to the need to use similar measures to assess language abilities in both languages. The decision to employ an identical assessment procedure for the English assessments meant that any apparent practice effects would be exclusive to the data collected for the Welsh assessments and consequently this limitation does not alter the finding that bilinguals and monolinguals with DS performed comparably. Future research with larger samples should endeavour to employ counterbalancing methods in order to further explore language outcomes in this population.

Finally, parental reports were used to ascertain the hearing status and DS subtype, which are both important factors to consider when assessing the language abilities of children with DS. Although this approach is consistent with a number of research studies with this population, medical documentation of hearing status and genetic testing are likely to provide more reliable estimations of these

factors compared to parental reports. Where possible, future studies should aim to obtain medical documentation of DS subtype and hearing status in order to increase the reliability of information pertaining to these factors.

5.2. Clinical and educational implications

The findings of this research and previous research should be taken into consideration when decisions are made regarding home, school and therapy language use. Clinicians should employ evidence-informed practice when it comes to providing advice to parents and educational professionals surrounding bilingualism. In considering the notion of forced monolingualism (i.e. restricting language input to a single language), numerous important implications have been highlighted in the literature. Firstly, it may be very challenging for families to modify their home language use and parents may feel less at ease in communicating in a non-native language (Hampton, Rabagliati, & Fletcher-Watson, 2017). If parents are not as proficient in the community language as they are in their native language, this may inadvertently reduce the quantity and quality of language input. For example, Hudry et al., (2017) reported shorter and less fluent interactions in children with ASD who had English as an additional language (EAL) after parents received recommendations to speak English only to their child. The authors noted that this finding raised concerns regarding the social development of these children, which is known to be particularly compromised in ASD, to begin with.

In children with ASD, the importance of early caregiver-child interactions (Siller & Sigman, 2002) and the role of linguistic input (Bang & Nadig, 2015) have been documented as important factors to language success. Consequently, further repercussions may be observed if these are reduced as a result of non-native language use in the home environment. Similar consequences may be observed for those with DS. Recent research suggests that professionals working with children who have a DD are starting to be more positive towards bilingualism than previously reported (Marinova-Todd, Colozzo, Mirenda, Stahl, Kay-Raining Bird, Parkington, et al., 2016). Nevertheless, policies and resources in light of these findings are required to ensure that appropriate practice takes place, which will then allow bilingual children with DS to be fully included and supported in bilingual communities and receive appropriate educational provisions.

5.3. Conclusion

To conclude, the current study is the first piece of research that reports on the language profiles of bilingual children with DS in the UK in comparison to developmentally matched monolingual children with DS as well as TD control groups. We report comparable abilities and comparable profiles of strengths and weaknesses for children with DS exposed to either one or two languages. This research could suggest that children with DS can flourish in bilingual services and educational systems and these bilingual services should be available to children with DS in Wales. Future professional recommendations and policies should employ evidence-informed practice, reflecting the findings presented in this research. Furthermore, researchers have raised caution with regard to discontinuing exposure to a home language, which may occur as a result of parents receiving advice to avoid exposing their child to a bilingual environment and only use the community language at home. These concerns relate to a lack of consistency of language input which may inadvertently hinder language development, particularly if parents are not as proficient in the community language as they are in their native language, leading to a reduction in the quality and quantity of language input. This research supports and extends previous findings which document no adverse outcomes for bilingual children with DS. The findings presented raise a number of important implications regarding bilingualism in children with DS, both within Wales and in other bilingual settings.

CRediT authorship contribution statement

Rebecca Ward: Conceptualization, Methodology, Investigation, Resources, Data curtion, Formal analysis, Visualization, Project administration, Writing – original draft. **Eirini Sanoudaki:** Funding acquisition, Supervision, Conceptualization, Methodology, Resources, Writing – review & editing.

Declaration of Competing Interest

The authors report no conflicts of interest.

Acknowledgements

The authors would like to express their gratitude to the families, schools and support staff for all their assistance with the research. We would also like to thank the UK Down's Syndrome Association and Learning Disabilities Wales for collaborating and promoting the project. We are thankful to Enlli Thomas, Marco Tamburelli and the anonymous reviewers for their valuable recommendations and constructive feedback provided in reviewing earlier versions of this paper.

Funding

This research was supported by an ESRC Wales-DTP studentship (grant number 1790820) secured by the second author in collaboration with the UK Down's Syndrome Association and awarded to the first author, and supported financially by the School of Languages, Literatures and Linguistics at Bangor University.

References

Abbeduto, L., Murphy, M. M., Cawthon, S. W., Richmond, E. K., Weissman, M. D., Karadottir, S., & O'Brien, A. (2003). Receptive language skills of adolescents and young adults with Down or fragile X syndrome. *American Journal on Mental Retardation, 108*(3), 149–160. https://doi.org/10.1352/0895-8017(2003)108<0149:RLSOAA>2.0.CO;2.

Adesope, O. O., Lavin, T., Thompson, T., & Ungerleider, C. (2010). A Systematic Review and Meta-Analysis of the Cognitive Correlates of Bilingualism. *Review of Educational Research, 80*(2), 207–245. https://doi.org/10.3102/0034654310368803.

Andreou, G., & Katsarou, D. (2013). Language Learning in Children with Down Syndrome (DS): Receptive and Expressive Morphosyntactic Abilities. *Procedia - Social and Behavioral Sciences, 93*, 921–924. https://doi.org/10.1016/j.sbspro.2013.09.304.

Arango, P. S., Aparicio, A., & Tenorio, M. (2018). Developmental trajectories of children with Down syndrome by socio-economic status: the case of Latin America. *Journal of Intellectual Disability Research, 62*(9), 759–774. https://doi.org/10.1111/jir.12516.

Bang, J., & Nadig, A. (2015). Learning language in autism: Maternal linguistic input contributes to later vocabulary. *Autism Research, 8*(2), 214–223. https://doi.org/10.1002/aur.1440.

Bialystok, E. (2015). Bilingualism and the Development of Executive Function: The Role of Attention. *Child Development Perspectives, 9*(2), 117–121. https://doi.org/10.1111/cdep.12116.

Bialystok, E., & Barac, R. (2012). Emerging bilingualism: Dissociating advantages for metalinguistic awareness and executive control. *Cognition, 122*(1), 67–73. https://doi.org/10.1016/j.cognition.2011.08.003.

Bialystok, E., Majumder, S., & Martin, M. (2003). Developing phonological awareness: Is there a bilingual advantage? *Applied Psycholinguistics, 24*(1), 27–44. https://doi.org/10.1017/S014271640300002X.

Biemiller, A., & Slonim, N. (2001). Estimating root word vocabulary growth in normative and advantaged populations: Evidence for a common sequence of vocabulary acquisition. *Journal of Educational Psychology, 93*(3), 498–520. https://doi.org/10.1037/0022-0663.93.3.498.

Boudreau, D. (2002). Literacy skills in children and adolescents with Down syndrome. *Reading and Writing, 15*(5), 497–525. https://doi.org/10.1023/A:1016389317827.

Branum-Martin, L., Tao, S., Garnaat, S., Bunta, F., & Francis, D. J. (2012). Meta-analysis of bilingual phonological awareness: Language, age, and psycholinguistic grain size. *Journal of Educational Psychology, 104*(4), 932–944. https://doi.org/10.1037/a0027755.

Burgoyne, K., Duff, F. J., Nielsen, D., Ulicheva, A., & Snowling, M. J. (2016). Bilingualism and Biliteracy in Down Syndrome: Insights From a Case Study. *Language Learning, 66*(4), 945–971. https://doi.org/10.1111/lang.12179.

Campbell, R., & Sais, E. (1995). Accelerated metalinguistic (phonological) awareness in bilingual children. *British Journal of Developmental Psychology, 13*(1), 61–68. https://doi.org/10.1111/j.2044-835X.1995.tb00664.x.

Canbay, O. (2011). Comparing the phonological awareness of bilingual and monolingual pre-school children. *Procedia - Social and Behavioral Sciences, 15*, 976–980. https://doi.org/10.1016/j.sbspro.2011.03.224.

Cardoso-Martins, C., França Michalick, M., & Cury Pollo, T. (2002). Is sensitivity to rhyme a developmental precursor to sensitivity to phoneme?: Evidence from individuals with Down syndrome. *Reading and Writing An Interdisciplinary Journal, 15*(5-6), 439–454. https://doi.org/10.1023/A:1016330313939.

Carlson, S. M., & Meltzoff, A. (2008). *Developmental Science, 11*(2), 282–298. https://doi.org/10.1111/j.1467-7687.2008.00675.x.

Carnine, D. W., Silbert, J., Kame'enui, E. J., & Tarver, S. G. (2004). Direct Instruction Reading. *In Pearson Allyn Bacon Prentice Hal*.

Chen, X., Anderson, R. C., Li, W., Hao, M., Wu, X., & Shu, H. (2004). Phonological Awareness of Bilingual and Monolingual Chinese Children. *Journal of Educational Psychology*. https://doi.org/10.1037/0022-0663.96.1.142.

Cleave, P. L., Kay-Raining Bird, E., Trudeau, N., & Sutton, A (2014). Syntactic bootstrapping in children with Down syndrome: the impact of bilingualism. *Journal of Communication Disorders, 49*, 42. https://doi.org/10.1016/j.jcomdis.2014.02.006.

Cohen, C. (2016). Relating input factors and dual language proficiency in French–English bilingual children. *International Journal of Bilingual Education and Bilingualism, 19*(3), 296–313. https://doi.org/10.1080/13670050.2014.982506.

Cossu, G., Rossini, F., & Marshall, J. (1993). When reading is acquired but phonological awareness is not: A study of literacy in children with Down syndrome. *Cognition, 1*(46), 129–138.

Cossu, G., Shankweiler, D., Liberman, I. Y., Katz, L., & Tola, G. (1988). Awareness of phonological segments and reading ability in Italian children. *Applied Psycholinguistics, 9*(1), 1–16. https://doi.org/10.1017/S0142716400000424.

Cupples, L., & Iacono, T. (2000). Phonological awareness and oral reading skill in children with Down syndrome. *Journal of Speech, Language & Hearing Research, 43*(3), 595–608. http://doi.org/10.1044/jslhr.4303.595.

de Bruin, A., Treccani, B., & Della Sala, S. (2015). Cognitive Advantage in Bilingualism: An Example of Publication Bias? *Psychological Science, 26*(1), 99–107. https://doi.org/10.1177/0956797614557866.

De Houwer, A. (1999). Environmental factors in early bilingual development: The role of parental beliefs and attitudes. *Bilingualism and Migration*, 75–96.

Drysdale, H., van der Meer, L., & Kagohara, D. (2015). Children with Autism Spectrum Disorder from Bilingual Families: a Systematic Review. *Review Journal of Autism and Developmental Disorders, 2*(1), 26–38. https://doi.org/10.1007/s40489-014-0032-7.

Duncan, L. G., Casalis, S., & Col, P. (2009). Early metalinguistic awareness of derivational morphology: Observations from a comparison of English and French. *Applied Psycholinguistics, 30*(3), 405–440. https://doi.org/10.1017/S0142716409090213.

Edgin, J. O., Kumar, A., Spanò, G., & Nadel, L. (2011). Neuropsychological effects of second language exposure in Down syndrome. *Journal of Intellectual Disability Research, 55*(3), 351–356. https://doi.org/10.1111/j.1365-2788.2010.01362.x.

Feltmate, K., & Kay-Raining Bird, E. (2008). Language learning in four bilingual children with Down syndrome: a detailed analysis of vocabulary and morphosyntax/L'apprentissage du langage chez quatre enfants bilingues atteints du syndrome de Down : une analyse detaillee du vocabulaire et de la morph. *Canadian Journal of Speech-Language Pathology & Audiology, 32*(1), 6.

Fletcher, H., & Buckley, S. (2002). Phonological awareness in children with Down syndrome. *Down's Syndrome, Research and Practice : The Journal of the Sarah Duffen Centre /University of Portsmouth, 8*(1), 11–18. https://doi.org/10.3104/reports.123.

Gathercole, V. C., & Thomas, E. M. (2009). Bilingual first-language development: Dominant language takeover, threatened minority language take-up. *Bilingualism, 12*(2), 213–237. https://doi.org/10.1017/S1366728909004015.

Gathercole, V. C., Thomas, E. M., Kennedy, I., Prys, C., Young, N., Guasch, N. V., Roberts, E. J., Hughes, E. K., & Jones, L. (2014). Does language dominance affect cognitive performance in bilinguals? Lifespan evidence from preschoolers through older adults on card sorting, Simon, and metalinguistic tasks. *Frontiers in Psychology, 5*(11). https://doi.org/10.3389/fpsyg.2014.00011.

Gathercole, V. C., & Thomas, E. M. (2007). *Prawf Geirfa Cymraeg, Fersiwn 7-11.* (Welsh Vocabulary Test, Version 7-11).

Gonzalez-Barrero, A. M., & Nadig, A. (2018). Bilingual children with autism spectrum disorders: The impact of amount of language exposure on vocabulary and morphological skills at school age. *Autism Research, 11*(12), 1667–1678. https://doi.org/10.1002/aur.2023.

Grosjean, F. (2012). Bilingual and Monolingual Language Modes. *The Encyclopaedia of Applied Linguistics*. https://doi.org/10.1002/9781405198431.wbeal0090.

Goswami, U., Porpodas, C., & Wheelwright, S. (1997). Children's orthographic representations in English and Greek. *European Journal of Psychology of Education, 12*(3), 273–292. https://doi.org/10.1007/BF03172876.

Grosjean, F. (1989). Neurolinguists, beware! The bilingual is not two monolinguals in one person. *Brain and Language, 36*(1), 3–15. https://doi.org/10.1016/0093-934X(89)90048-5.

Haman, E., Wodniecka, Z., Marecka, M., Szewczyk, J., Białecka-Pikul, M., Otwinowska, A., Mieszkowska, K., Łuniewska, M., Kołak, J., Miękisz, A., Kacprzak, A., Banasik, N., & Foryś-Nogala, M. (2017). How does L1 and L2 exposure impact l1 performance in bilingual children? Evidence from Polish-English migrants to the United Kingdom. *Frontiers in Psychology, 8*. https://doi.org/10.3389/fpsyg.2017.01444.

Hambly, C., & Fombonne, E. (2014). Factors influencing bilingual expressive vocabulary size in children with autism spectrum disoders. *Research in Autism Spectrum Disorders, 8*, 1079–1089. https://doi.org/10.1016/j.rasd.2014.05.013.

Hammer, C. S., Komaroff, E., Rodriguez, B. L., Lopez, L. M., Scarpino, S. E., & Goldstein, B. (2012). Predicting Spanish–English Bilingual Children's Language Abilities. *Journal of Speech Language and Hearing Research, 55*(5), 1251. https://doi.org/10.1044/1092-4388(2012/11-0016).

Hampton, S., Rabagliati, H., & Fletcher-Watson, S. (2017). Autism and Bilingualism: A Qualitative Interview Study of Parents' Perspectives and Experiences. *Journal of Speech, Language, and Hearing Research, 60*(2). https://doi.org/10.1044/2016_JSLHR-L-15-0348.

Hart, B., & Risley, T. R. (1995). *Meaningful Differences in the Everyday Experience of Young American Children*. Paul H Brookes Publishing.

Howard, K. B., Katsos, N., & Gibson, J. L. (2019). The school experiences of bilingual children on the autism spectrum: An interpretative phenomenological analysis. *Research in Developmental Disabilities, 87*, 9–20. https://doi.org/10.1016/j.ridd.2019.01.008.

Hudry, K., Rumney, L., Pitt, N., Barbaro, J., & Vivanti, G. (2017). Interaction Behaviors of Bilingual Parents With Their Young Children With Autism Spectrum Disorder. *Journal of Clinical Child & Adolescent Psychology, 47*, 1–8. https://doi.org/10.1080/15374416.2017.1286592.

Hulme, C., Goetz, K., Brigstocke, S., Nash, H. M., Lervåg, A., & Snowling, M. (2012). The growth of reading skills in children with Down syndrome. *Developmental Science, 15*(3), 320–329. https://doi.org/10.1111/j.1467-7687.2011.01129.x.

Jarrold, C., & Baddeley, A. D. (2001). Short-term memory in Down syndrome: applying the working memory model. *Down's Syndrome, Research and Practice: The Journal of the Sarah Duffen Centre /University of Portsmouth*. https://doi.org/10.3104/reviews.110.

Kay-Raining Bird, E., Genesee, F., & Verhoeven, L (2016). Bilingualism in children with developmental disorders: A narrative review. *Journal of communication disorders, 63*, 1–14. https://doi.org/10.1016/j.jcomdis.2016.07.003.

Kaufman, A. S., & Kaufman, N. L. (2004). Kaufman Brief Intelligence Test, Second Edition. In *Encyclopedia of Special Education*. Pearson Assessment. https://doi.org/10.1002/9781118660584.ese1325.

Kay-Raining Bird, E., Cleave, P., Trudeau, N., Thordardottir, E., Sutton, A., & Thorpe, A (2005). The Language Abilities of Bilingual Children With Down Syndrome. *American Journal of Speech-Language Pathology, 14*(3), 187–199. https://doi.org/10.1044/1058-0360(2005/019.

Kay-Raining Bird, E., Lamond, E., & Holden, J (2012). Survey of bilingualism in autism spectrum disorders. *International Journal of Language & Communication Disorders /Royal College of Speech & Language Therapists, 47*(1), 52. https://doi.org/10.1111/j.1460-6984.2011.00071.x.

Kennedy, E. J., & Flynn, M. C. (2003). Early phonological awareness and reading skills in children with Down syndrome. *Down's Syndrome, Research and Practice : The Journal of the Sarah Duffen Centre/University of Portsmouth, 8*(3), 100–109. https://doi.org/10.3104/reports.136.

Kremer-Sadlik, T. (2005). To Be or Not to Be Bilingual: Autistic Children from Multilingual Families. *ISB4: The 4th Annual Symposium on Bilingualism*, 1225–1234.

Kuo, L. J., Uchikoshi, Y., Kim, T. J., & Yang, X. (2016). Bilingualism and phonological awareness: Re-examining theories of cross-language transfer and structural sensitivity. *Contemporary Educational Psychology, 46*, 1–9. https://doi.org/10.1016/j.cedpsych.2016.03.002.

Lehtonen, M., Soveri, A., Laine, A., Järvenpää, J., de Bruin, A., & Antfolk, J. (2018). Is bilingualism associated with enhanced executive functioning in adults? A meta-analytic review. *Psychological Bulletin, 144*(4), 394–425. https://doi.org/10.1037/bul0000142.

Marian, V., & Shook, A. (2012). The cognitive benefits of being bilingual. *Cerebrum : The Dana Forum on Brain Science, 13*.

Marinova-Todd, S. H., Colozzo, P., Mirenda, P., Stahl, H., Kay-Raining Bird, E., Parkington, K., Cain, K., de Valenzuela, J. S., Segers, E., MacLeod, A. A. N., & Genesee, F (2016). Professional practices and opinions about services available to bilingual children with developmental disabilities: An international study. *Journal of Communication Disorders, 63*, 47–62. https://doi.org/10.1016/j.jcomdis.2016.05.004.

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

Næss, K. A. B. (2016). Development of phonological awareness in Down syndrome: A meta-analysis and empirical study. *Developmental Psychology, 52*(2), 177–190. https://doi.org/10.1037/a0039840.

Næss, K. A. B., Lervåg, A., Lyster, S. A. H., & Hulme, C (2015). Longitudinal relationships between language and verbal short-term memory skills in children with Down syndrome. *Journal of Experimental Child Psychology, 135*, 43–55. https://doi.org/10.1016/j.jecp.2015.02.004.

Newman, R., Ratner, N. B., Jusczyk, A. M., Jusczyk, P. W., & Dow, K. A. (2006). Infants' early ability to segment the conversational speech signal predicts later language development: A retrospective analysis. *Developmental Psychology, 42*(4), 643–655. https://doi.org/10.1037/0012-1649.42.4.643.

Öney, B., & Durgunoğlu, A. (1997). Beginning to read in Turkish: A phonologically transparent orthography. *Applied Psycholinguistics, 18*(1), 1–15.

Paap, K. R., & Greenberg, Z. I. (2013). There is no coherent evidence for a bilingual advantage in executive processing. *Cognitive Psychology, 66*(2), 232–258. https://doi.org/10.1016/j.cogpsych.2012.12.002.

Paradis, J. (2010). The interface between bilingual development and specific language impairment. *Applied Psycholinguistics, 31*(2), 227–252. https://doi.org/10.1017/S0142716409990373.

Paradis, J., Crago, M., Genesee, F., & Rice, M. (2003). French-English Bilingual Children With SLI: How Do They Compare With Their Monolingual Peers? *Journal of Speech, Language, and Hearing Research, 46*(1), 113–127. https://doi.org/10.1044/1092-4388(2003/009.

Pungello, E. P., Iruka, I. U., Dotterer, A. M., Mills-Koonce, R., & Reznick, J. S. (2009). The Effects of Socioeconomic Status, Race, and Parenting on Language Development in Early Childhood. *Developmental Psychology, 45*(2), 544–557. https://doi.org/10.1037/a0013917.

Roberts, J. E., Price, J., Barnes, E., Nelson, L., Burchinal, M., Hennon, E. A., Moskowitz, L., Edwards, A., Malkin, C., Anderson, K., Misenheimer, J., & Hooper, S. R. (2007). Receptive vocabulary, expressive vocabulary, and speech production of boys with fragile X syndrome in comparison to boys with down syndrome. *American Journal on Mental Retardation, 112*(3), 177–193. https://doi.org/10.1352/0895-8017(2007)112.

Royal College of Speech and Language Therapists. (2019). *Bilingualism Overview*. https://www.rcslt.org/speech-and-language-therapy/clinical-information/bilingualism#section-4.

Semel, E., Wiig, E. H., & Secord, W. A. (1998). *Clinical Evaluation of Language Fundamentals* (Third Edition). The Thirteenth Mental Measurements Yearbook.

Siller, M., & Sigman, M. (2002). The Behaviors of Parents of Children with Autism Predict the Subsequent Development of Their Children's Communication. *Journal of Autism and Developmental Disorders, 32*(2), 77–89. https://doi.org/10.1023/A:1014884404276.

Spencer, L. H., & Hanley, R. J. (2003). Effects of orthographic transparency on reading and phoneme awareness in children learning to read in Wales. *British Journal of Psychology, 94*(1), 1–28. https://doi.org/10.1348/000712603762842075.

Spencer, L. H. (2000). *The role of phonological awareness in the beginning reading of Welsh and English speaking children*. Thesis: Doctorate in Philosophy.

Tamburelli, M., Sanoudaki, E., Jones, G., & Sowinska, M. (2015). Acceleration in the bilingual acquisition of phonological structure: Evidence from Polish–English bilingual children. *Bilingualism: Language and Cognition, 18*(4), 713–725. https://doi.org/10.1017/S1366728914000716.

Thordardottir, E. (2017). Amount trumps timing in bilingual vocabulary acquisition: Effects of input in simultaneous and sequential school-age bilinguals. *International Journal of Bilingualism, 23*(1), 236–255. https://doi.org/10.1177/1367006917722418.

Trudeau, N., Kay-Raining Bird, E., & Cleave, P (2011). *Développement lexical chez les enfants bilingues avec Trisomie 21*. Enfance. https://doi.org/10.4074/S0013754511003089.

Valicenti-McDermott, M., Tarshis, N., Schouls, M., Galdston, M., Hottinger, K., Seijo, R., Shulman, L., & Shinnar, S. (2013). Language differences between monolingual English and bilingual English-Spanish young children with autism spectrum disorders. *Journal of Child Neurology, 28*(7), 945–948. https://doi.org/10.1177/0883073812453204.

Vallar, G., & Papagno, C. (1993). Preserved Vocabulary Acquisition in Down's Syndrome: The Role of Phonological Short-term Memory. *Cortex, 29*(3), 467–483. https://doi.org/10.1016/S0010-9452(13)80254-7.

Verhoeven, L. (2007). Early bilingualism, language transfer, and phonological awareness. *Applied Psycholinguistics, 28*, 425–439. https://doi.org/10.1017/S0142716407070233.

Verucci, L., Menghini, D., & Vicari, S. (2006). Reading skills and phonological awareness acquisition in Down syndrome. *Journal of Intellectual Disability Research, 50*(7), 477–491. https://doi.org/10.1111/j.1365-2788.2006.00793.x.

von Bastian, C. C., Souza, A. S., & Gade, M. (2016). No evidence for bilingual cognitive advantages: A test of four hypotheses. *Journal of Experimental Psychology: General, 115*(2), 246–258. https://doi.org/10.1037/xge0000120.

Ward, R., & Sanoudaki, E. (2020). Bilingualism in children with a dual diagnosis of Down syndrome and Autism Spectrum Disorder. *Clinical Linguistics and Phonetics*. https://doi.org/10.1080/02699206.2020.1818288.

Wilkinson, K. M., & Mazzitelli, K. (2003). The effect of 'missing' information on children's retention of fast-mapped labels. *Journal of Child Language, 30*(1), 47–73. https://doi.org/10.1017/S0305000902005469.

Woll, B., & Grove, N. (1996). On Language Deficits and Modality in Children with Down Syndrome: A Case Study. *Proceedings of the Annual Boston University Conference on Language Development, 20*(2), 837–848.