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BRIEF REPORT

Brief Report: An Exploratory Study of Lexical Skills in Bilingual Children with Autism Spectrum Disorder

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Abstract Studying lexical diversity in bilingual children with autism spectrum disorders (ASD) can contribute important information to our understanding of language development in this diverse population. In this exploratory study, lexical comprehension and production and overall language skills were investigated in 14 English–Chinese bilingual and 14 English monolingual preschool-age children with ASD. Results indicated that both groups had equivalent scores on all but one measure of language and vocabulary, including English production vocabulary, conceptual production vocabulary, and vocabulary comprehension. When comparing the two languages of bilingual participants, there were no significant differences in production vocabulary size or vocabulary comprehension scores. The results provide evidence that bilingual English–Chinese preschool-age children with ASD have the capacity to function successfully as bilinguals.

Keywords Bilingual · ASD · Vocabulary · CDI · Chinese

Introduction

In the first half of the twentieth century, it was widely believed that bilingualism had negative effects on the cognitive abilities of typically-developing children, and some even suggested that bilingual individuals suffered from a so-called "language handicap" (see Macnamara 1966 for a review). However, research evidence over the past 50 years has shown consistently that bilingual children have better cognitive and linguistic abilities in areas such as concept formation and metalinguistic awareness, relative to their monolingual peers (see Bialystok 2001 for a review). Nonetheless, child development professionals frequently advise bilingual families to speak only one language to their child with autism spectrum disorder (ASD) (e.g., Kremer-Sadlik 2005; Leadbitter et al. 2009). Many parents and professionals believe that bilingual exposure negatively affects language development, especially for children with ASD (Hambly and Fombonne 2009), despite a dearth of research evidence that supports this belief.

The term 'bilingual' refers to a heterogeneous population in terms of the relative levels of proficiency speakers have in their two languages (Thordardottir et al. 2006). Today, the most commonly accepted understanding of the term bilingual is that it refers to individuals who use two or more languages or dialects in their everyday lives. In general, bilingual language acquisition follows the same developmental path as monolingual language acquisition, but bilinguals tend to have smaller vocabularies in each of their languages compared to monolingual children (Pearson et al. 1993). However, when the two vocabularies are added together and translation equivalents (i.e., the same vocabulary words in both languages, such as 'dog' and 'chien') are counted only once, bilingual children typically have vocabularies of an equivalent size to monolingual children. This vocabulary measurement is known as a conceptual vocabulary score.

Evidence suggests that bilingualism itself does not negatively affect first language development in children

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with language impairment (Thordardottir et al. 1997). The type of language deficit, the severity of the language disorder, and the manner and availability of input in each language all influence language learning. Bilingual children with language impairments may learn language at a slower pace and to a lesser extent than their typically developing bilingual peers, but they do learn language to the same level as their monolingual peers with language learning difficulties (Kohnert 2007).

There is a dearth of published research in the area of ASD and bilingualism, with only two published journal articles to date (Kremer-Sadlik 2005; Seung et al. 2006). However, all of the available research, including poster presentation data from recent conferences (Hambly and Fombonne 2009; Leadbitter et al. 2009; Valicenti-McDermott et al. 2008), suggests that there is no negative impact of bilingualism on language development in children with ASD. Therefore, a more in-depth description of early language development in bilingual children with ASD, with a focus on lexical skills in particular, is required, as lexical skills are considered to be a reliable predictor of language development in children with ASD (Condouris et al. 2003).

The goal of this exploratory study was to investigate the lexical skills of monolingual and bilingual children with ASD, using methods similar to those commonly used with typically-developing bilingual children (e.g., Pearson et al. 1993; Thordardottir et al. 2006) and with bilingual children with ASD (Hambly and Fombonne 2009). It was hypothesized that the monolingual and bilingual children would have conceptual production vocabularies that were not significantly different in size, and that the comprehension vocabularies and language scores of the bilingual children would not be significantly smaller than those of the monolinguals.

Methods

Participant Recruitment

A total of 28 children from a major metropolitan area in Canada participated in this study. Because language exposure, language proficiency, and other language-specific factors can affect the vocabulary scores of bilingual children, we sought to recruit a group of bilingual children with ASD that was as homogeneous as possible. Thus, the 14 bilingual participants were all exposed to both Chinese and English and the 14 monolingual participants were exposed to English only.

The 14 bilingual participants were recruited through speech-language pathologists and behaviour consultants who contacted clients meeting the requirements for this study. Families were invited to participate if: (a) their child had an ASD diagnosis and no other diagnosis; (b) the child was exposed simultaneously to both Chinese (either Cantonese or Mandarin) and English before the age of 3, and was hearing and speaking both languages on a daily basis at the time of testing; (c) at least one parent could speak, read, and write in English and at least one parent could speak, read, and write in Chinese; (d) the child had a production vocabulary of at least 30 words across both languages,[1] as indexed by scores on both the CDI—Words and Sentences (CDI; Fenson et al. 1993) and on the Cantonese or Putonghua (also known as Mandarin) CDI (CCDI; PCDI; Tardif and Fletcher 2008).

The 14 monolingual children were participants in a previous research project that examined early intervention outcomes for children with autism and their parents (Mirenda et al. 2005). They all met the same diagnostic and production vocabulary criteria on the CDI as the bilingual children. They were exposed only to English in their homes and in all intervention settings.

Participants

The bilingual group consisted of 13 boys and 1 girl and ranged in age from 43 to 73 months, with an average age of 59 months. They spoke primarily Chinese at home and English in the rest of the community. Ten of the families spoke Mandarin and 4 spoke Cantonese. Four participants had a PDD-NOS diagnosis and 10 had an autism diagnosis. Thirteen of the 14 children were diagnosed at a government multidisciplinary assessment health care centre. The fourteenth child was diagnosed by a private organization that used a similar diagnostic process. In all cases, diagnosis was made using the Autism Diagnostic Interview-Revised (Rutter et al. 2003), and/or the Autism Diagnostic Observation Schedule (Lord et al. 2001). Prior to the time of testing, the bilingual children had participated in an average of 107 h of speech-language therapy (ranging from 0 to 360 h), 506 h of structured behaviour therapy (ranging from 0 to 1,632 h), and 802 h of total therapy (ranging from 308 to 1,712 h), according to parent reports.

The monolingual group consisted of 13 boys and 1 girl whose chronological ages ranged from 44 to 73 months, with an average of 59 months. They were selected from a larger pool of 43 monolingual children with ASD who were enrolled in a previous study (Mirenda et al. 2005). Two of these children had a diagnosis of PDD-NOS and 12 had a diagnosis of autism. All of the monolingual children

[1] A minimum of 30 words was selected because it is at about this point in early language development that typically-developing children's vocabularies begin to include both nouns and verbs rather than nouns only.

were diagnosed using the Childhood Autism Rating Scale (Schopler et al. 1988). Prior to testing, they had attended an average of 51 h of speech-language therapy (ranging from 0 to 216), 686 h of structured behaviour therapy (ranging from 0 to 2,324), and 934 h of total therapy (ranging from 35.5 to 2,618).

Measures

The Peabody Picture Vocabulary Test-III (PPVT-III; Dunn and Dunn 1997). The PPVT-III is a norm-referenced standardized assessment tool designed to measure single word receptive vocabulary skills for English. The PPVT-III and the equivalent Chinese (Mandarin) version of the PPVT (Lu and Liu 1994) were administered.[2]

The Preschool Language Scale (PLS-3; Zimmerman et al. 1992). The PLS-3 is a standardized diagnostic instrument created to assess comprehension and production language skills in infants and young children. Two subscores, an Auditory Comprehension score and an Expressive Communication score, were calculated for use in this study.

The Mullen Scales of Early Learning (MSEL; Mullen 1995). The MSEL is a measure of cognitive functioning for infants and children from birth through 68 months of age (Mullen 1995). The Visual Reception and Fine Motor Scales from the MSEL were combined in this study to estimate nonverbal IQ (NVIQ), as per previous studies of children with ASD (Chawarska et al. 2007; Lord et al. 2001).

The Communicative Development Inventories. Parents of bilingual children were given both the English CDI (Fenson et al. 1993) and a Chinese PCDI or CCDI (Tardif and Fletcher 2008); parents of monolingual children completed the English CDI only. The CCDI and PCDI were standardized for typically developing Cantonese- and Mandarin-speaking children between 8 and 30 months of age. The long forms were used for the purposes of this study because they provide a more thorough assessment of language ability than the short forms, which only provide a subset of the long form.

Several scores were calculated using the CDI and the PCDI or CCDI, including: (a) an English CDI raw score for each child, which was the total number of English words parents checked off as spoken by their child; (b) a Chinese CDI raw score for all bilingual children, which was the total number of Chinese words parents checked off as spoken by their child; (c) a total vocabulary score for each child, which consisted of the English CDI raw score for the monolinguals and the English CDI raw score summed with the Chinese CDI raw score for the bilinguals; and (d) a total conceptual vocabulary score for each child, which was designed as a measure of all concepts lexicalized in either language by the child. For the monolinguals, this measure consisted of the English CDI raw score. For the bilinguals, this measure consisted of all the words in one language plus all the words from the other language that represented concepts or linguistic functions not on the CDI in the first language. A single concept known by different words in English and Chinese was counted only once in the total conceptual vocabulary. For example, "mother" in English and the equivalent "媽媽" in Chinese were counted only once.

Procedure

Matching was based on similar chronological ages at the time of testing, in order to control for the duration of total language exposure. Two meetings were held over a 3-week period in the home of each bilingual family. Administration of the four tests was counter-balanced to ensure that no order effect occurred and participants were randomly assigned to the different testing schedules. Furthermore, the English and Chinese versions of the PPVT were never administered on the same day.

Results

Table 1 displays the results of preliminary analyses that were conducted to examine group differences on a number of relevant demographic variables.

Independent *t* test analyses confirmed that the two language groups did not differ with regard to chronological age or therapy hours in any combination. However, there was a significant difference between the groups with regard to NVIQ scores; thus, we controlled for NVIQ by including it as a covariate in subsequent analyses.

A multivariate analysis of covariance (MANCOVA) with group as the independent variable and NVIQ as a covariate was performed on three scores that included the English CDI, total vocabulary, and conceptual vocabulary scores. Table 2 presents the descriptive statistics for the three variables.

There was a significant effect for group after controlling for the effect of NVIQ, $F(3, 23) = 4.22$, $p = 0.016$; Wilk's $\lambda = 0.65$, $\eta_p^2 = 0.36$. Subsequent univariate ANCOVAs on

[2] When these data were collected, the only available standardized measure of Chinese vocabulary that was equivalent to the English PPVT had been developed and standardized in Taiwan. Together with language development experts who were also native speakers of both Mandarin and Cantonese, we examined every item on the test and assured that it would be appropriate for children speaking Cantonese. On this basis, we deemed it appropriate to rely on standard scores as comparison guidelines for the four Cantonese-speaking participants in our study, but the interpretations should be treated with caution.

Table 1 Descriptive statistics comparing monolingual and bilingual participant groups on chronological age, nonverbal IQ and therapy hours received (N = **28**)

Measure	Monolingual (n = 14) Mean (SD)	Bilingual (n = 14) Mean (SD)	*t*	df	*p*
Chronological age	59.03 (9.94)	59.00 (10.81)	0.006	26	0.99
NVIQ estimate (MSEL)	59.29 (23.62)	91.36 (21.96)	3.72	26	0.001
Total therapy hours	933.79 (784.92)	802.29 (380.31)	0.56	26	0.58
Speech-language and structured behavior therapy hours combined	736.71 (609.00)	612.71 (424.77)	0.63	26	0.54
Speech-language therapy hours	51.00 (59.89)	106.57 (98.25)	1.81	26	0.08
Structured behavior therapy hours	685.71 (603.26)	506.14 (456.22)	0.89	26	0.34

Table 2 Descriptive statistics comparing monolingual and bilingual participant groups on lexical and language measures (N = **28**)

Measure	Monolingual (n = 14) Mean (SD)	Bilingual (n = 14) Mean (SD)
English CDI Score	410.86 (187.27)	476.79 (124.15)
Total vocabulary score	410.86 (187.27)	855.14 (318.04)
Conceptual vocabulary score	410.86 (187.27)	666.43 (188.86)
English PPVT (standard score)	68.86 (24.65)	96.79 (17.35)
PLS-3 Auditory comprehension (standard score)	65.14 (17.08)	89.57 (18.38)
PLS-3 Expressive communication (standard score)	61.50 (15.72)	78.86 (24.38)

Key: *CDI* communication development inventory, *PPVT* Peabody picture vocabulary test-III, *PLS-3* preschool language scale, 3rd ed

each of the scores with group as the independent variable and NVIQ as covariate revealed that there was a significant group effect for total vocabulary scores, $F(1, 25) = 6.79$, $p = 0.02$, $\eta_p^2 = 0.21$ but not for either English CDI scores or conceptual vocabulary scores.

A second MANCOVA with group as the independent variable and NVIQ as covariate was performed on three language measures—standard scores on the English PPVT, the PLS-3 Auditory Comprehension subscale (AC), and the PLS-3 Expressive Communication (EC) scales. The effect of group on the language measures after controlling for the effect of NVIQ was not statistically significant; thus, no further analyses were conducted.

Finally, pairwise *t* tests were conducted to compare the English and Chinese scores of the bilingual participants. No significant differences were found between the English (M = 476.79, SD = 124.15) and Chinese (M = 378.21, SD = 273.31) total vocabulary scores or the English (M = 96.79, SD = 17.35) and Chinese (M = 79.50, SD = 36.15) PPVT scores.

Discussion

The results of this exploratory study suggest that bilingualism does not negatively affect language development in young children with ASD. When NVIQ was controlled, bilingual children had larger total production vocabularies and equivalent conceptual vocabulary and English vocabulary sizes compared to chronological-age-matched monolingual children with ASD. This is consistent with previous research that has found typically developing bilingual children to have conceptual vocabularies that are equal in size or larger than those of monolingual typically developing children (e.g., Pearson et al. 1993). This is also in line with previous research on children with Down syndrome, which also found no evidence for a negative effect of bilingualism on language development (Kay-Raining Bird et al. 2005), and on children with ASD (Hambly and Fombonne 2009). Finally, this was the first study to evaluate the lexical development of bilingual children with ASD in both of their languages and to have both languages be the same for all bilingual participants. There were no differences in the children's lexical skills across the two languages, although their English scores tended to be higher than their Chinese scores.

The primary limitation of this study was a small sample size for both the monolingual and bilingual groups, and the related possibility that we did not find significant differences between the groups because of a lack of power (i.e., a Type II error). We attempted to conserve power by using a multivariate approach to data analysis, even though it was necessary to utilize a covariate; and we were able to detect a significant difference for total vocabulary size between the two groups, which suggests that power may not have been an issue. Nonetheless, the results should be treated as

suggestive rather than definitive, and future research with larger sample sizes is required to examine this issue more thoroughly. Future studies should also employ the same diagnostic measures for ASD across all participants, comparable measures in both languages (e.g. PLS-3), and participants who are matched on NVIQ at the outset.

Taken together, the data from this exploratory study suggests that children with ASD have the potential to be bilingual, and that speaking Chinese at home and English at school and in therapy does not appear to disadvantage their language development. The information resulting from this study should be taken into consideration when speech-language pathologists and other early child development professionals prepare to advise families regarding language use. It appears that the suspicion or diagnosis of ASD in a child who is raised bilingually should not result in an immediate recommendation to eliminate one of the languages. Support for two languages does not necessarily mean treating both in the same way at the same time; rather, language goals should be consistent with the child's previous experiences and current and future needs (Kohnert 2007).

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