

LANGUAGE PRACTICE IN CHINESE AMERICAN FAMILIES RAISING A CHILD WITH
AUTISM—RELATIONS BETWEEN LANGUAGE EXPOSURE, LANGUAGE
STRATEGIES, AND CHILD BILINGUAL ACQUISITION

by

QI WEI

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Student: Qi Wei

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This dissertation has been accepted and approved in partial fulfillment of the requirements for the Doctor of Philosophy degree in the Department of Special Education and Clinical Sciences by:

Wendy Machalicek, PhD, BCBA-D	Chairperson
Laura Lee McIntyre, PhD, BCBA-D	Core Member
Stephanie De Anda, PhD, CCC-SLP	Core Member
Dare Baldwin, PhD	Institutional Representative

and

Krista Chronister	Vice Provost for Graduate Studies
-------------------	-----------------------------------

Original approval signatures are on file with the University of Oregon Division of Graduate Studies.

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DISSERTATION ABSTRACT

Qi Wei

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Title: Language Practice in Chinese American Families Raising a Child with Autism - Relations Between Language Exposure, Language Strategies, and Child Bilingual Acquisition

The present study explored the relationship between amount of dual language exposure, parents' language quality and bilingual competence among Chinese American children with autism spectrum disorder by using a cross-sectional correlational design. Thirty parent-child dyads participated in this study. Survey and observational data were collected online. Results suggest that professional advice and autism severity were not significantly related to amount of reductions in heritage language exposure. Caregivers reduced their use of Mandarin in home environment regardless of the severity levels of their child's autism symptoms. Language exposure accounted for significant variations in bilingual outcomes with higher amount of exposure to each language contributing to larger expressive vocabulary size in each language. The findings reflected that parents' use of follow-in comment and repeat contributed to Mandarin expressive vocabulary, while expansion and question asking contributed to English expressive vocabulary. Implications for future research and culturally adapted interventions for bilingual families are provided.

CURRICULUM VITAE

NAME OF AUTHOR: Qi Wei

GRADUATE AND UNDERGRADUATE SCHOOLS ATTENDED:

University of Oregon, Eugene
University of Wisconsin-Madison, Madison, WI
Nankai University, Tianjin, China

DEGREES AWARDED:

Doctor of Philosophy, 2022, University of Oregon
Master of Science, 2016, University of Wisconsin-Madison
Bachelor of Arts, Nankai University

AREAS OF SPECIAL INTEREST:

Evidence-based practices for children with autism and other developmental disabilities
Culturally responsive interventions for children and families with diverse backgrounds
Bilingualism and language interventions for children with autism

PROFESSIONAL EXPERIENCE:

Graduate Teaching Assistant, University of Oregon, Special Education Program, 2017-2022
Graduate Teaching Assistant, University of Wisconsin-Madison, Human Development and Family Studies Program, 2014-2016
Behavior Therapist, University of Oregon, HEDCO Autism Assessment and ABA Clinic, 2018-2022

GRANTS, AWARDS, AND HONORS:

Organization for Autism Research (OAR) Graduate Research Grant 2019G04, 2019
International Society for Autism Research (INSAR) Professionals from Low Income Countries Travel Award, 2020
Increasing Racial/Ethnic Diversity in ABA Research-ABA Research Lab Scholarship, University of Oregon, 2021
Doctoral Conference Award, College of Education, University of Oregon, 2021

PUBLICATIONS:

Wei, Q., Machalicek, W., Crowe, B., Kunze, M., & Rispoli, M (2021). Restricted and repetitive patterns of behavior and interests in children with autism spectrum disorder: A systematic review of behavioral interventions. *Education and Training in Autism and Developmental Disabilities*, 56(2), 115-139.

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CHAPTER I

INTRODUCTION

Bilingualism and Language Development in Children with Autism

There has been a large increase in the proportion of the U.S. population that speaks more than one language due to globalization and immigration during the past 50 years. Twenty-three million people or 11% of the population spoke another non-English language in 1980, while 67.8 million or around 25% of the population spoke a language other than English in 2019 (Rumbaut & Massey, 2013; U.S. Census Bureau, 2019). According to the American Community Survey record for 2008-2010, in the four states with the highest number of immigrants, California, New Mexico, Texas and New York, an average of 36% of the population spoke a non-English language at home (Rumbaut & Massey, 2013). The most commonly spoken non-English language in the U.S. is Spanish, and the next most spoken language is Chinese, followed by Tagalog, Vietnamese, Arabic and French (U.S. Census Bureau, 2019). Among populations speaking these languages aged 5 years or older, an average of 42.9% individuals (ranging from 16.4% to 60.1%) reported they spoke English “less than very well” (U.S. Census Bureau, 2019). With bilingualism becoming an increasingly common phenomenon, a large number of children are now raised in linguistically diverse families where many caregivers are not proficient in the societal language.

Autism spectrum disorder (ASD) is a neurodevelopmental disorder characterized by deficits in social communication and restricted and repetitive behaviors and interests that has a lifelong impact on a child’s adaptive functioning and quality of life (American Psychiatric Association, 2013; de Vries & Geurts, 2015). The prevalence rate of ASD has also increased rapidly during the past two decades, partially due to changes in identification practices and

reductions in racial disparities in diagnosis (Center for Disease Control, 2020). One in 150 (0.7%) children aged 8 years had an ASD diagnosis in 2000, but the prevalence rate increased to 1 in 44 (2.2%) in 2018 (Maenner et al., 2020).

The intersection of bilingualism and ASD creates unique challenges for linguistically diverse families raising a child with ASD in the United States. Professionals have frequently and erroneously recommended to bilingual parents that they speak the societal language exclusively with their child (Drysdale et al., 2015; Kay-Raining Bird et al., 2012). The rationale behind this recommendation lies in the hypothetical “cognitive overload” generated by exposure to two languages (Hampton et al., 2017). Specifically, a child has to understand that one concept can be symbolized by two or more words in two languages (“translation equivalents”; Petitto et al., 2001). Different language systems also involve different phonology, semantics, syntax and pragmatics, and such inconsistencies may further delay the acquisition of receptive and expressive skills across both languages, given the inherent impairment in the child’s joint attention (Adamson et al., 2009; Mundy et al., 1990; Paradis et al., 2011). However, as discussed in detail below a large body of work has since disproven this hypothesis despite the fact that it continues to be perpetuated.

For bilingual parents with inadequate English proficiency who could not communicate in English effectively with their children, such a recommendation may increase parenting stress and reduce the quality of parent-child interactions (Kremer-Sadlik, 2005). Even for highly educated bilingual parents with fluent English, they have often expressed a preference for their heritage language as it allowed for colloquialisms that enhance emotions and promote intimacy (Hudry et al., 2018; Yu, 2016). On the other hand, children do not learn a language for its own sake, they are socialized through a language, i.e., language opens the door to ideologies, moral values, and

social expectations of a cultural community (Ochs & Schieffelin, 1984). A shift in family language practice to exclusive use of English with the child with ASD may negatively affect the child's relationship with extended family members who only speak the heritage language (e.g., grandparents as primary or secondary caretakers) and lead to a loss of mother tongue and cultural identity in the long term (Paradis et al., 2018; Yu et al., 2013).

Research on bilingualism in children with ASD burgeoned in recent years, but current research evidence does not support the recommendation for restricting input to a single language. Bilingual children with ASD do not exhibit further delays in language skills compared to monolingual peers with ASD (Conner et al., 2020; Drysdale et al., 2015; Wang et al., 2018). In Ohashi et al.'s (2012) study, 20 bilingually-exposed (English or French and various second languages) preschool-age children with ASD were compared with 40 monolingually-exposed (English or French) children with similar age and non-verbal intelligence quotient (NVIQ) on six language measures: communication impairment based on autism diagnostic measures, age of first words, age of first phrases, expressive language, receptive language and functional communication scores. No significant differences were found in any of these measures between the groups. Petersen et al. (2012) evaluated the lexical skills of 14 bilingually-exposed (English and Chinese) preschool-age children with ASD and 14 monolingually-exposed (English) children with ASD, specifically in the area of receptive and expressive vocabulary, and total expressive and conceptual vocabulary. Controlling for NVIQ, the bilingually-exposed group had a larger total expressive vocabulary than their monolingually-exposed counterparts, and no statistically significant differences were found in other measures between two groups. Except for having equivalent or better language outcomes than monolingual peers, bilingual children with ASD also demonstrated more desirable outcomes in some other developmental areas. In two

studies conducted among toddlers who were bilingually-exposed in English and various second languages (Valicenti-McDermott et al., 2012; Zhou et al., 2019), the bilingually-exposed group were more likely to use gestures, and had more advanced pretend play skills and higher adaptive functioning. Recent work over the last decade suggests that children with ASD raised in linguistically diverse families have the capacity for bilingualism, and bilingual exposure may actually produce some positive impacts on broader developmental outcomes.

Despite the positive findings on the capacity for bilingualism among children with ASD, many bilingual caregivers do not have access to this evidence and struggle in trying to make the correct decision for their child. In fact, two common themes that emerged from qualitative research studies and literature reviews on experiences and needs of linguistically diverse families raising a child with ASD were: (a) anxieties and fears of dual language exposure, and (b) a lack of materials and intervention services in the family's heritage language (Kay-Raining Bird et al., 2012; Lim et al., 2018; Papoudi et al., 2020). For example, Papoudi et al. (2020) examined 32 studies that included over 5,000 families from South Asian, Hispanic, and African American cultural backgrounds in the U.S. and UK. Caregivers reported receiving sparse information on language learning specific to the ASD population, lack of bilingual service providers and even discrimination during interactions with service providers due to language barriers. Caregiver anxiety about potentially harming their child's language development through dual language exposure and lack of service supports for heritage languages can both negatively impact the quantity and quality of parent-child interactions (Papoudi et al., 2020; Paradis et al., 2018), which are two critical contributing factors for language development (Hart & Risely, 1992; Scharff Rethfeldt et al., 2020).

The early intervention field has recently started to formulate practice guides for bilingual service delivery, with emphases on both quantity and quality of language input: (a) making information regarding bilingualism and ASD available to caregivers to alleviate stress about the decision and increase heritage language input to support a bilingual choice, and (b) training clinicians to provide culturally and linguistically responsive and specific intervention strategies in caregivers' use of heritage language to enhance quality of language input (American Speech-Language-Hearing Association; Lim et al., 2018; Peredo, 2016; Scharff Rethfeldt et al., 2020; Uljarević et al., 2016). Understanding what factors influence parents' decision about quantity of heritage language input is the first step to support their bilingual choice (Kay-Raining Bird et al., 2012). For example, caregivers who choose to speak English exclusively due to their child's limited verbal ability will need differential support than caregivers who choose to do so due to professional advice. In addition, exploring whether there is a difference in the quality of language input when parents use the societal language versus the heritage language to interact with their child is crucial for clinicians' service delivery. Lim et al. (2018) proposed that as a remedy for lack of bilingual competence, clinicians can provide parent training in English and encourage caregivers to practice intervention strategies in their heritage language. This suggestion is made based on the premise that caregivers can successfully generalize intervention strategies from one language condition to the other. However, based on previous qualitative studies this premise is likely false; bilingual caregivers may need additional support in the use of either (or both of) the societal language or the heritage language. There is a dearth of knowledge about factors influencing quantity of caregiver language input and whether quality of parent-child interactions differ across different language conditions (i.e., societal and heritage

language). Without exploring these questions in depth, even if acknowledging the general practice guide, families and professionals are still forced to function in a “knowledge vacuum.”

Quantity of Language Input: Bilingualism and Family Language Practice

For children experiencing language delays and receiving an ASD diagnosis in early childhood, caregivers in bilingual families often report feeling they had no choice but to limit the child’s exposure to heritage language (Hampton et al., 2017; Paradis et al, 2018; Yu, 2013). Caregivers’ choice to speak more English at home was motivated by a combination of child characteristics and social cultural factors. Specifically, the child’s overall functioning level and verbal ability, professional advice, parental concern about the child’s lack of capacity for bilingualism and a desire to achieve utmost intervention efficacy by maintaining consistency in language used at home and during intervention all played a role in caregivers’ decision-making process (Paradis et al., 2018; Yu, 2018).

Findings from qualitative and survey research suggested that the majority of bilingual families switched to speaking more of the societal language at home after the child received an ASD diagnosis (Hudry et al., 2018; Paradis et al., 2018). For example, Paradis et al. (2018) measured language practice among 30 bilingual families raising a school-age child (mean age = 85 months) with ASD in Canada. Most parents in this study spoke more English to their child than the heritage language. Nine out of 30 children almost only spoke English at home. All children heard some heritage language, with one family speaking English almost always. Parents reported that naturalness in communication, effective communication with extended family members, their limited English proficiency and belief in child’s capacity for bilingualism were contributing factors to their heritage language use.

Hampton et al.'s (2017) and Yu (2018) found that caregivers whose child had more severe autism symptoms and lower verbal ability were more likely to adopt an entirely monolingual environment. Such changes in family language practice may lead to negative implications for the child's language development. Compared to neurotypical bilingual children, children with ASD who were highly verbal could speak the societal language to a similar extent; but all children with ASD suffered from consequential heritage language loss compared to neurotypical peers due to reduced language exposure (Paradis et al., 2018). Hambly and Fombonne (2014) substantiated the critical role of language exposure on nondominant language (the language spoken to the child less often). Their findings indicated that recent nondominant language exposure accounted for 69% of variance in the vocabulary size of nondominant language among children with ASD. Additionally, cognitive and social impairment did not preclude nondominant language development. With an adequate amount of exposure, children with ASD who had intellectual disability and lower social responsiveness could develop vocabulary in nondominant language. Unfortunately, most caregivers still chose to restrict bilingualism for their child, despite concerns about diluted intimacy among family members and the child losing cultural identity and connections to minority communities (Conner et al., 2020).

It is noteworthy that some families may reintroduce heritage language as stress caused by the diagnosis lessens. In a qualitative study conducted with three second-generation Chinese American caregivers raising a child with ASD (Yu, 2018), two families shifted from an English only environment to a bilingual environment 2 years after the child's diagnosis. One mother reported the impetus for this change was due to a recent Mandarin assessment, in which her child demonstrated some solid knowledge in Mandarin even after 18 months of monolingual exposure in English. The other parent's decision on Mandarin exposure was influenced by his child's rapid

language development after receiving intervention. Both parents were motivated by their child's intense interest in learning and communicating in Mandarin and determined to use Mandarin more often at home.

Undoubtedly, family language practice in bilingual families raising a child with ASD is a complex and fluid social phenomenon. Parents' decisions about language practice have significant implications on the child's heritage language development through the mediation of the amount of language input. One of the lingering questions is to understand the extent to which contributing factors including child's autism severity and advice from professionals impact the amount of heritage language input.

Quality of Language: Language Strategies in Parent-Child Interaction

Parents teach their young child new language everyday through modeling and expansion. And for young children with ASD, it seems parents' influence on their child's language is even more prominent than that of peers compared to neurotypical children. Neurotypically developing children can learn from peers' language practice during play and social interactions, but children with ASD are less likely to develop positive interactions and cooperative play with their peers which limits their learning opportunities (Locke et al., 2012). For example, children with ASD were found to have accents more similar to those of their bilingual mothers, while their neurotypical siblings' accents more resembled those of the peer group (Baron-Cohen & Stauton, 1994). In bilingual families raising a child with ASD, parents' language may be particularly influential to their language development.

Joint engagement has been found as a critical predictor of expressive and receptive language among children with ASD. It explained significant variation in language development, even after cognitive functioning and autism severity were taken into account (Yoder et al., 2015).

Because joint engagement was malleable through treatment, enhancing the child's joint attention became a core component of naturalistic developmental behavioral intervention models that target spontaneous communication (e.g., Enhanced Milieu Teaching [EMT], Kaiser & Roberts, 2013; Joint Attention Symbolic Play, Engagement, and Regulation [JASPER], Kasari et al. 2006; Early Start Denver Model [ESDM], Dawson et al., 2010). Core categories of language strategies to support joint attention development include using verbalizations aligned with the child's current attentional focus (i.e., making follow-in comments and directives) and responding to the child's communicative bids in a sensitive manner (i.e., linguistic mapping, repeating and language expansions; Mcduffie & Yoder, 2010; Siller & Sigman, 2002). Children whose caregivers used these strategies more frequently in free play during early childhood developed more spoken language several months later and in middle childhood, compared to those whose caregivers used these strategies less often (Haebig et al., 2013; Siller & Sigman, 2008). More importantly, caregiver use of language strategies predicted child's expressive language, after the child's cognitive functioning level, duration of engagement with toys, and number of utterances during free play were taken into account (Mcduffie & Yoder, 2010; Siller & Sigman, 2008).

For bilingual families raising a child with ASD, the intriguing question is whether language strategies used in the societal language are of comparable quality as they are used in the heritage language. Very few studies have explored the quality of language used by bilingual parents of children on the autism spectrum during parent-child interactions. Findings from qualitative research indicated that parents generally felt unconfident and unable to fully communicate their ideas when speaking the societal language in unfamiliar contexts (Kremer-Sadlik, 2005; Yu, 2016). Moreover, high proficiency achieved in traditional measures of societal language, for example a rigorous language test, were associated with higher level of fluency and

comfort in professional situations but not in unpredictable social situations (Yu, 2016). In Yu's study (2016), seven out of 10 parents completed graduate studies in the U.S., however they still found mundane parent-child interactions in English effortful and unnatural. These parents did not grow up in the same social context as their child and shared experience was lacking.

Spontaneous and unpredictable social interactions could catch parents unprepared. For instance, one parent did not know the word "itchy", while the other parent did not know the word "gravity" when trying to explain how avalanche worked during family TV time (Kremer-Sadlik, 2005; Yu, 2016). Parents also expressed that as complexity in the child's language increased, their communication became more difficult. These qualitative studies indicated two common themes: (a) parents in bilingual families may use language strategies less effectively in the societal language compared to their mother tongue, and (b) language quality decreases as conversational demands increase when parents use the societal language versus heritage language.

However, conflicting findings emerged from two quantitative studies in which observations of parent-child interactions during free play were analyzed to compare language strategy use in heritage language condition and societal language condition. Hudry et al. (2018) compared parent use of synchrony (i.e., verbalizations aligned with the child's current focus of attention), repeating and expansions among 20 monolingual parents and 19 bilingual parents of children with similar age, autism severity and NVIQ. Their findings suggested that bilingual parents have lower levels of synchrony and expansions compared to monolinguals.

Counterintuitively, when focusing solely on bilingual parents' language quality, lower levels of expansions were observed in the use of heritage language versus the societal language (English). Total number of utterances, synchrony and repeating did not differ across two language

conditions. In a later study, Smith et al. (2020) conducted secondary analysis using the same dataset and found that bilingual parents demonstrated fewer verbal interactions (i.e., responsiveness) with their child under the heritage language condition compared to English interactions when frequency of child's utterances was taken into consideration. Both studies suggested that within the bilingual group, higher parental English proficiency was associated with higher language quality, for example higher responsiveness (Smith et al., 2020) and more repeating (Hudry et al., 2018).

It may be counterintuitive that expansions and responsiveness were reduced when bilingual parents used heritage language versus non-heritage English. Both groups of researchers discussed possible reasons for this phenomenon. Hudry et al. (2018) pointed out an important consideration: heritage language status was inconsistent with choice of dominant language (language used most often spoken to the child) at home. Post-hoc data on parents' habitual language use indicated that many parents (11 out of 19 in their sample) had adopted English as their dominant language. Moreover, children's English and heritage language level were not measured and child's utterances during free play were not taken into account in this study. Therefore, parents' use of more expansions in non-heritage English are likely due to higher levels of child's communicative bids during free play. Smith et al. (2020) emphasized other considerations: acculturation and services received in non-heritage language were likely to enhance parents' responsiveness in English. Responsiveness to child-led interactions is more valued in English-speaking cultures but directive parenting is more prevalent in many other cultures (Washbrook et al., 2012). Early intervention services and direct coaching parents received in English may improve their responsiveness. In contrast, responsive interactions in

heritage language may be less valued by bilingual parents due to subordinated social status of heritage languages and lack of services in heritage languages (Paradis et al., 2018; Yu, 2016)

Due to different research methodologies and small, heterogenous samples being collected at different geographical locations in previous studies, it is understandable that researchers obtained mixed findings on language quality. But a mixture of research findings also suggested researchers had limited knowledge of what factors actually influenced bilingual parents' language quality to generate "justifiable" hypotheses. According to previous studies child variables including duration of toy engagement and number of communication acts should not be overlooked, because they serve as confounding variables in determining bilingual parents' language quality.

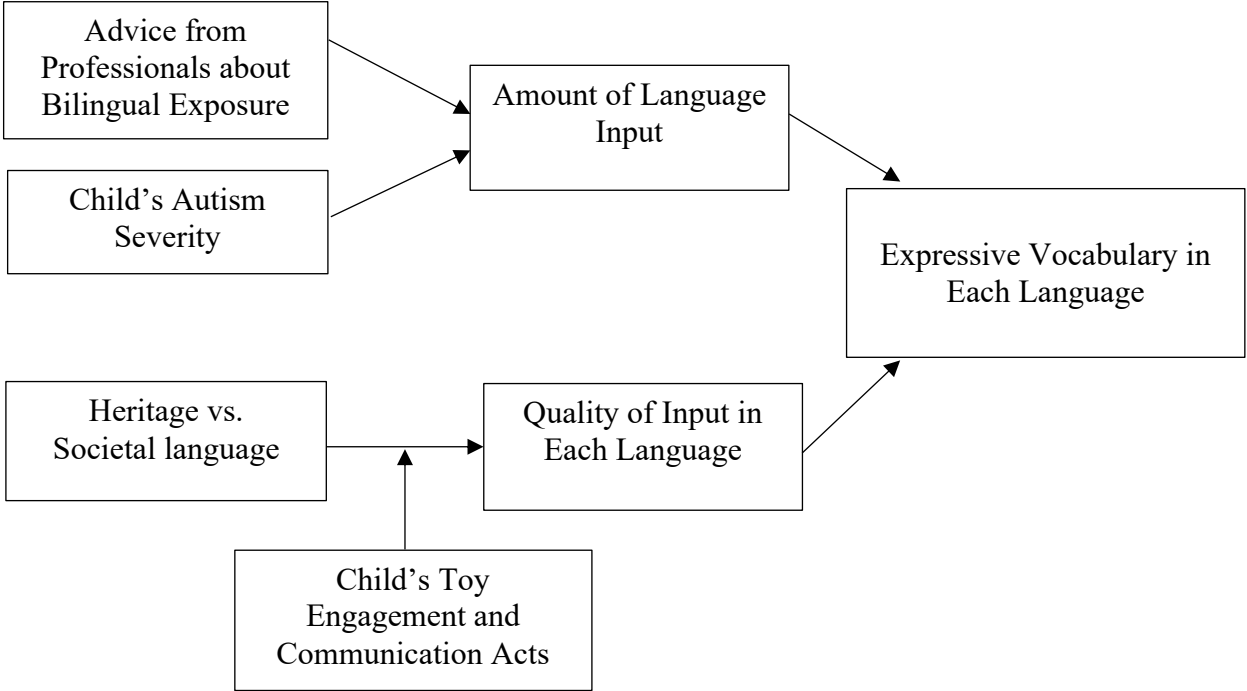
Specific Aims of the Present Study

Chinese is the third most used language in the US, and 56% of Chinese language speakers reported they cannot speak English very well (US Census Bureau, 2019). Chinese American is also one of the fastest growing ethnic minority groups (US Census Bureau, 2017). Chinese American children with ASD are underdiagnosed and their parents encounter barriers in navigating the service system and advocating for their child to obtain appropriate services (Baio et al., 2018; Son et al., 2017). Chinese American parents may be at elevated risk for ineffective communication with professionals and experiencing greater difficulty in providing quality parenting to their child. Several qualitative research studies suggested that Chinese American caregivers raising a child on the autism spectrum had the motivation to promote their child's English language development but had limited professional support to do so. In addition, caregivers valued Chinese language but chose to restrict input if it was perceived to hinder the children's English language acquisition (Yu, 2013; Yu, 2016). To date, no quantitative research

has systematically examined possible factors that influence the language practice in Chinese American families raising a child with ASD. The present study aims to bridge this gap by exploring contributing factors for the quantity and quality of language input and providing a further understanding on language development of bilingual English-Chinese preschool-age children with ASD.

Figure 1

Conceptual model depicting the relations between amount of language input, quality of language input and child’s expressive vocabulary



The purpose of the study is to understand factors that influence heritage language input and whether language quality differs across language conditions among Chinese American families raising a child on the autism spectrum (Figure 1). Based on previous research, quantity of language input can be affected by negative advice on bilingualism from professionals and the child’s autism severity. Quality of language may be influenced by language condition and

moderated by the child's behaviors during parent-child interaction. The impact of language input and language quality on child's expressive vocabulary will also be explored. The research questions are:

1. Is there a negative relation between autism severity and the amount of heritage language input, controlling for advice from professionals?
2. Do caregivers use less heritage language at home if they received negative professional advice on dual language exposure, controlling for the child's autism severity?
3. Do children have more toy engagement and higher frequency of communication acts in heritage language compared to societal language condition during free play?
4. Do caregivers display more follow-in comments and directives in heritage language compared to societal language condition during free play, controlling for duration of toy engagement?
5. Do caregivers display more linguistic mapping, repeating, expansions and responding in heritage versus societal language condition, controlling for frequency of the child's communication acts?
6. Is there a positive relation between the amount of language exposure and language quality and early English and Mandarin language development, controlling for chronological age and autism severity?

CHAPTER II

METHOD

Participants

A total of 30 parent-child dyads from several major metropolitan areas in the U.S. participated in this study. With a known effect size of language input on expressive vocabulary (Hambly & Fambonne, 2014), a power analysis was conducted in G*Power (Faul et al., 2007) to determine the minimum sample size. Thirty bilingual (English and Mandarin) parents were recruited through professionals who contacted clients meeting the requirements for this study, parent support group and parents who referred their friends to participate. Recruitment flyers were distributed through WeChat and other social media platforms. The flyer instructed caregivers to confirm whether they met the inclusion criteria for this study: (a) having a child aged 2-6 years old with an ASD medical diagnosis or educational classification; (b) the child has been exposed to both English and Mandarin at some point in their development and (c) the child can speak some words in at least one language and produce sentences of less than five words; and (d) at least one parent speaks Mandarin Chinese as primary language. The intentions behind these criteria were three-fold: (a) these children are more likely to live in bilingual environments, (b) parents are primary agents of socialization and language development for preschool-age children, and (c) the vocabulary measures used in the study are likely to be developmentally appropriate for this group of children.

Sample demographic characteristics are reported in Table 1. This study included thirty female caregivers between the ages of 30 and 56 years ($M = 37.22$ years, $SD = 4.91$). Most caregivers (93%) held a bachelor's degrees or a graduate degree, and the median household income lies in the \$100,00-149,999 range. For child characteristics, the average age was 46

months ($SD = 14.94$), and the mean age of obtaining an autism diagnosis was 27 months ($SD = 27.79$). On average, children in the current sample spoke the first word in Mandarin at 17 months ($SD = 8.94$) whereas they spoke the first English word at 24 months ($SD = 11.04$). Regarding quantity of dual language exposure, large reductions of Mandarin input were observed in this group. Specifically, Mandarin input accounted for 87% of the overall language input and English input made up for the remainder 12% from birth to the present. Mandarin input decreased to 45% and English input increased to 53% in the overall language environment after child receiving an autism diagnosis. In general, Chinese American children in this sample had similar vocabulary size in Mandarin ($M = 252.53$, $SD = 240.05$) and in English ($M = 281.43$, $SD = 204.98$).

Table 1

Sample Characteristics (N = 30)

	<i>n</i> or (<i>M</i>)	% or (<i>SD</i>)
Caregiver variables		
Mother	30	100%
Age	(37.22)	(4.91)
Parent Educational Level		
High school education or less	1	3%
Vocational training	1	3%
Bachelor's degree	8	17%
Graduate degree or above	20	77%
Yearly Household Income (\$)		
0-49,999	4	13%
50,001-74,999	5	17%
75,000-99,999	1	3%
100,00-149,999	4	13%
150,000-199,999	5	17%
>200,000	11	37%

Table 1 (continued).

	<i>n</i> or (<i>M</i>)	% or (<i>SD</i>)
Marital Status		
Married	28	93%
Divorced	2	7%
Advice on dual language exposure		
Only use English	2	7%
Dual language exposure	28	93%
Language proficiency by self-report		
English	(20.77)	(6.03)
Mandarin	(27.70)	(4.61)
Child variables		
Male child	22	73%
Age	(46.27 mos)	(14.94)
Age of diagnosis	(27.47 mos)	(27.79)
Autistic symptoms		
Normal	4	13%
Mild	6	20%
Moderate	8	27%
Severe	12	40%
Age of first word		
Mandarin	(16.90 mos)	(8.94)
English	(24.47 mos)	(11.04)
Mandarin exposure		
Before diagnosis	(86.77)	(19.40)
After diagnosis	(45.53)	(21.68)
English exposure		
Before diagnosis	(12.17)	(17.15)
After diagnosis	(52.60)	(21.69)
Service hours received	(400.00)	(370.28)

Table 1 (continued).

	<i>n</i> or (<i>M</i>)	% or (<i>SD</i>)
Vocabulary		
Mandarin	(252.53)	(240.05)
English	(281.43)	(204.98)

Procedure

A webpage link was embedded in the recruitment flyer that directed eligible parents to the consent form webpage. Parents read about participants' responsibility and potential risks and benefits involved in the study, then a typed signature was required before they entered the survey webpage. All surveys were translated from English to Mandarin, backtranslated from Mandarin to English and consensus-by-reconciliation by three doctoral students (who are also native Chinese speakers) and a faculty advisor in Special Education. Parents were asked to complete the surveys via Wenjuanxing (China's largest online questionnaire platform) and then scheduled a time for an interview and play observation with the research team. The play observation session was conducted and recorded through an online format via a secure platform, Zoom™. A \$15 WeChat red packet or an electronic gift card was sent to participants who completed all study procedures. Study protocol was approved by the Institutional Review Board of a university located in the Pacific Northwest.

Measures***Demographics and Background Questionnaire***

Demographic and background information collected for this study includes parents' educational level, household income, language preference, what advice regarding language use they received from professionals and their wish for child's heritage development. Child information includes age, gender, age of diagnosis, age of English learning and intervention

hours. General information regarding the child's current language environment was also collected, i.e., what language family members speak to the child and what language the child speaks to family members. Parents also provided overall ratings of the child's proficiency in Mandarin and English (Appendix A).

Language Experience and Proficiency Questionnaire

The Language Experience and Proficiency Questionnaire (LEAP-Q, Marian et al., 2007) was used to evaluate bilingual caregivers' level of proficiency in understanding, speaking and reading as well as language history of Mandarin and English. The LEAP-Q (Marian et al., 2007) is a 16-item self-report questionnaire that measures a bilingual or multilingual individual's (age 14-80) language acquisition, language dominance, language preference, language competence and previous and current language exposure. The LEAP-Q has desirable reliability, construct validity and criterion validity (Kaushanskaya et al., 2019; Marian et al., 2007). The language competence section that contains three items on self-estimated proficiency in speaking, reading and understanding was used in this study. Each item is endorsed on an 11-point Likert scale (0: none - 10: perfect). A total score for the subscale ranging from 0-30 is used for reporting results, with higher scores indicating higher self-endorsed proficiency in English or Mandarin (Appendix B).

The Language Exposure Assessment Tool

The Language Exposure Assessment Tool (LEAT; DeAnda et al., 2016) was used to assess child participants' overall language input through interview administered via Zoom™. During interview, the primary caregiver provided specific information on the number of communicative partners the child has, the languages they speak and the amount of time they interact with the child in each language. Researchers entered this information in Excel Software

(Microsoft Corp., Redmond, WA) to calculate the amount of language exposure in both languages and calculate relative language exposure. The LEAT has been administered to evaluate language exposure of bilingual toddlers to establish high internal consistency and criterion validity (DeAnda et al., 2016; Appendix C).

Social Responsiveness Scale, Second Edition

The Social Responsiveness Scale (SRS-2; Constantino & Gruber, 2012) was distributed among caregivers to report their child's autism severity. SRS-2 is an informant-based behavioral rating scale used to evaluate the severity of autism traits in individuals with ASD. SRS-2 has 65 items that measure behaviors in five domains: social awareness, social cognition, social communication, social motivation and repetitive and restricted behavior and interests. Each item is endorsed on a 4-point rating scale for symptom severity from 1 (never true) to 4 (almost always true). A total score for the scale ranging from 65 to 260 is used for reporting results, with higher scores indicating more severe ASD symptoms. SRS-2 has different versions for preschool-age children (2.5- to 4-year-olds; Pine et al., 2006) and school-age children (4- to 18-year-olds; Constantino & Gruber, 2005). Both versions have high internal consistency, inter-rater reliability, construct validity and criterion validity; and its psychometric properties are also demonstrated to be desirable among Chinese populations aged 3-20 years old (Frazir et al., 2014; Gau et al, 2012; Pine et al., 2006).

MacArthur-Bates Communicative Development Inventories

Both Mandarin and English adaptations of MacArthur-Bates Communicative Development Inventories (Fenson et al., 2006; Tardif & Fletcher, 2008) were used to evaluate the child's expressive vocabulary through an interview via Zoom™. The English Communicative Development Inventories-Words and Sentences (ECDI-WS) and Mandarin

Communicative Development Inventories-Words and Sentences (MCDI-WS) are reliable and valid measurement tools that were standardized for typically development English-speaking and Mandarin-speaking children aged 8 to 30 months (Tardif et al., 2009; Thal et al., 2007).

Although having no normative data to reference yet, ECDI-WS and MCDI-WS have been used for children with developmental disabilities up to 7-year-old and were regarded as adequate measures for language competency in previous research studies (Hambly & Fombonne, 2014; Petersen et al., 2012). Total scores of vocabulary production section of ECDI-WS and MCDI-WS were used in this study as the indicator of language development in English and Mandarin during early childhood.

Parent-Child Interaction Observation

Prior to the free play session, parents were guided to choose several toy sets that are developmentally appropriate for their child via video teleconferencing through Zoom™. The researcher interviewed the parents to gather information on the child's current play level and what toys and materials parents already have at home. Based on the child's play level (simple play—combination play—pre-symbolic play—symbolic play; Ungerer & Sigman, 1981; Shire et al., 2018), the researcher made recommendations regarding toy selection and let the parents choose 3-4 toy sets according to availability from a toy list. The toy list includes dump truck, wind-up toys, stacking cups, shape sorters, bubbles, puzzles, blocks, kitchen and furniture set, little people tree house set, toy car garage play set and an animal barn toy set. Parents were asked to set up web camera and audio using a tablet or personal computer in the play area at home, and researchers will record the free play session using Zoom™. The order of language parents used were determined using a random number generator. Parents interacted with the child for 10 minutes using either English or Mandarin, then the researcher notified the parent to switch to the

other language for the remaining 10 minutes. Play sessions were recorded and the research team (comprised of special education doctoral students and speech language pathologists with early intervention background) coded the child's toy engagement and communication acts and parents' use of language strategies based on the coding protocol developed by McDuffie and Yoder (2010). Thirty percent of the play sessions were randomly selected to establish intercoder reliability.

Child's Toy Engagement and Caregiver's Responsiveness to Child's Attentional Focus. Regarding the child's toy engagement, the total duration of toy engagement in each language condition were coded using a 5s partial-interval coding system. The child had to be engaged in functional play for at least 3s during a 5s interval for the interval to be coded as "engaged", e.g., stacking the block rather than engaging in repetitive play with the block, put the animal in the barn instead of throwing the animal at the caregiver. Intervals during which the child engaged in behaviors other than functional play (e.g., self-stimulation, tantrum) were coded as "unengaged". Intervals were considered as "uncodable" if the coder could not see the child or the object the child was engaging with. For all intervals during which the child was considered as "engaged", caregiver's utterances were examined to determine whether the caregiver talks about the child's attentional focus. Caregiver's utterances responsive to the child's attention were coded as either: (a) follow-in comments that describe the child's behavior (e.g., child puts baby to sleep, parent says: "baby is sleepy") or b) directives that communicate an expectation to change the child's behavior (e.g., child holds a carrot, parent says: "now cut the carrot"). Intervals with utterances that did not belong to these two categories and unintelligible talking will be coded as "other talking". Intervals during which caregivers did not talk were coded as "no talking". The coders went through every play session twice. During the first pass, the coders

focused on the child's toy engagement, i.e., number of intervals coded as "engaged", "unengaged" or "uncodable". During the second pass, the coders focused on the caregiver's utterances, i.e., number of intervals coded as "follow-in comments" "follow-in directives" "other talking" or "no talking".

Child's Communication Acts and Caregiver's Responsiveness to Communication

Acts. Number of child's communication acts were coded using a frequency count system, which included: (a) conventional gestures or initiation of joint attention using gestures (e.g., coordinated eye contact, give, point, show), (b) gestures with recognizable sounds or word approximations (c) a word, a paraphrase or a sentence that is related to the toy or the play theme. Caregiver's responsiveness to communication acts were coded using a frequency count system, which included: (a) linguistic mapping that comments on the child's communicative intention (e.g., child shows the horse to parent, parent says: black horse), (b) repeating (e.g., child says "in", parent repeat: "in"), (c) expansion that adds information to the child's utterances (e.g., child says "red block", parents says "red block on top"). Because there were children with more advanced verbal ability in our sample (those who can speak sentences), two coding items were added beyond Mcduffie and Yoder's (2010) protocol: (d) responding with a question (e.g., child says "a cow says moo", parents asks "what does the pig say?") and (e) acknowledgement (e.g., child says "the car goes beep-beep", parent says "good job"). The coders went through every play session twice for the caregiver's behavior. During the first pass, the coders focused on the frequency of various types of communication acts emitted by the child. During the second pass, the coders focused on number of parents' utterances in each category (linguistic mapping, repeating, expansion or responding) occur within 3s after each child communication.

Interobserver Reliability. A third-year doctoral student who is proficient in Mandarin and English received training on the coding scheme and independently conducted coding for 30% of the videos. Interobserver agreement (IOA) was calculated by dividing the number of agreements by the total number of agreements plus disagreements and multiplying by 100. An IOA of 89% and 93% was obtained for duration of toy engagement and communication acts. The average IOA for parent verbal responsiveness is 87.5% (follow-in comments: 89%; follow-in directives: 85%; questions: 85%; linguistic mapping: 88%; repeat: 91%; expansion: 85%; respond with a question: 82%; acknowledgement: 94%).

CHAPTER III

RESULTS

Preliminary Analyses

To explore significant relationships between variables and determine potential covariates to be included in the regression analyses, bivariate correlational analyses were conducted for study variables that have an impact on expressive vocabulary based on previous research on language development and the conceptual framework of the present study (Figure 1). Particularly, child variables including age, gender and amount of service hours (total hours of services received) and parent variables including socioeconomic status (SES), self-reported language proficiency and attitude toward bilingualism were explored as potential correlates of expressive vocabulary size. The relationships between important independent variables comprising professional advice on dual language exposure, autism severity and amount of bilingual language input and expressive vocabulary were also evaluated in correlational analyses. Results indicated that amount of service hours positively associated with both Mandarin and English vocabulary size ($r = .39, p < .01$; $r = .47, p < .01$). Overall English exposure and Mandarin exposure after autism diagnosis correspondingly correlated with English vocabulary size and Mandarin vocabulary size in positive relations ($r = .48, p < .01$; $r = .36, p < .01$). These variables were introduced in regression analyses. Bivariate correlations between study variables are demonstrated in Table 2.

Table 2*Intercorrelations Between Study Variables*

Item/Scale	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. Child's age	1														
2. Child's gender	.03	1													
3. Autism severity	.22	.09	1												
4. Socioeconomic status	-.16	.07	-.04	1											
5. Advice on language exposure	.13	-.19	-.36	-.00	1										
6. Service hours	.66**	-.06	.30	-.17	.05	1									
7. Parent Mandarin proficiency	.31	.11	.35	.20	-.04	.39*	1								
8. Parent English proficiency	.02	-.26	.09	.39*	-.13	.08	.49**	1							
9. Parent attitude toward bilingualism	-.12	-.36*	.05	-.05	-.01	-.06	-.09	.15	1						

Table 2 (continued).

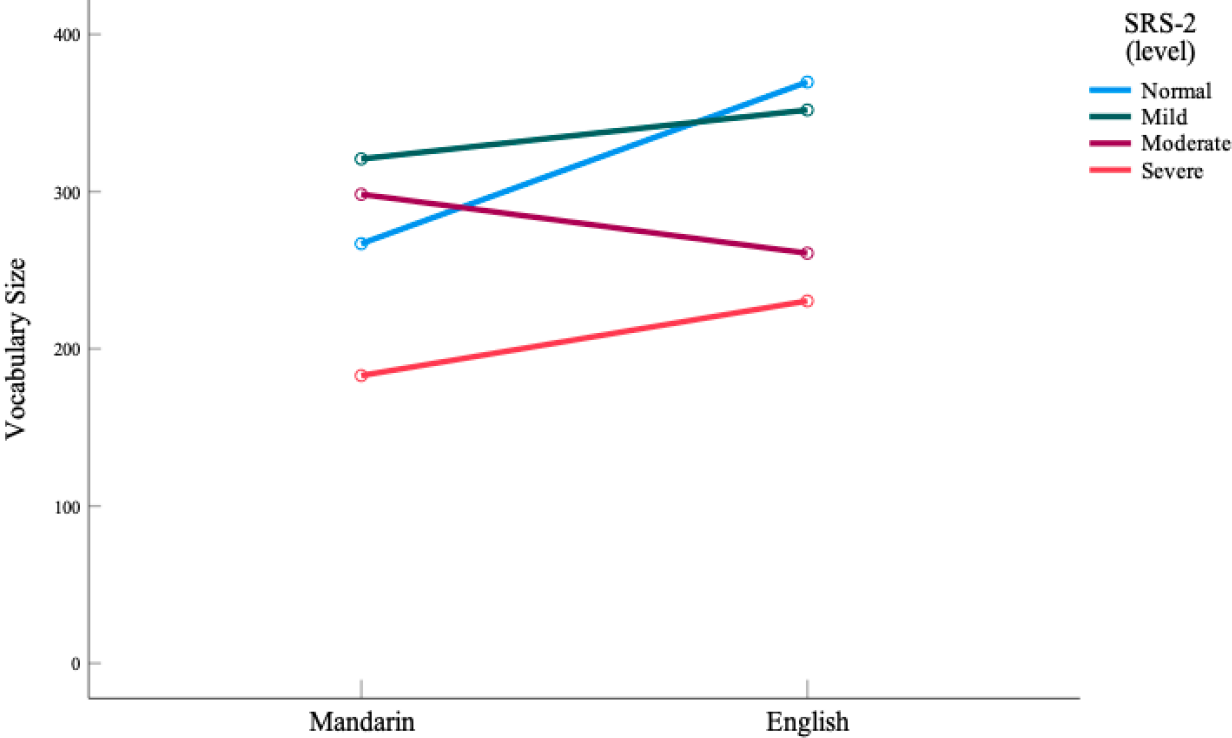
Item/Scale	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
10. Mandarin exposure (overall)	-.07	-.22	-.00	.09	-.13	-.11	-.11	-.31	.15	1					
11. English exposure (overall)	-.16	.04	.13	-.04	.07	.30	-.04	.23	.09	-.83**	1				
12. Mandarin exposure (after diagnosis)	-.02	-.35	.02	-.00	-.17	-.10	-.22	-.20	.24	.74**	-.60**	1			
13. English exposure (after diagnosis)	.05	.24	.08	.05	.08	.17	.17	.16	-.22	-.63**	.64**	-.94**	1		
14. English vocabulary	.49**	.12	-.17	.02	.20	.47**	-.09	-.14	-.12	-.34	.48**	-.23	.29	1	
15. Mandarin vocabulary	.40**	-.13	-.18	.05	.25	.39**	-.07	-.19	.01	.17	-.09	.36*	-.30	.56**	1

* $p < .05$, ** $p < .01$.

Additionally, beyond the finding from descriptive statistics that children in this sample have comparable vocabulary size in English and Mandarin, a repeated-measures analysis of variance (*ANOVA*) was conducted to evaluate whether this finding holds for children with different levels of autism severity, especially for those with severe autism (Figure 2). Results suggested that no significant difference was detected in the number of expressive words acquired in Mandarin and English regardless of autism severity, controlling for the child’s age. This finding indicated that children with profound autism can develop basic interpersonal communication skills in both languages. In other words, social impairment did not preclude the acquisition of basic bilingual competency.

Figure 2

Mean Differences in Vocabulary Size Affected by Autism Severity



Note. SRS-2 represents scores on Social Responsiveness Scale-2nd edition which indicates autism severity levels

Main Analyses

Autism Severity, Professional Advice and Heritage Language Exposure

To address the first two research questions about factors influencing heritage language input, a multiple regression analysis was conducted. According to previous conclusions from qualitative studies (Kay-Raining Bird et al., 2012; Hampton et al., 2017), severe autism symptoms and professional advice on restricting language input to English ought to predict less exposure to heritage language after receiving an autism diagnosis. Results of the present study did not support these findings (Table 3). Contrary to the hypotheses, no significant predicting associations were found between autism severity, professional advice on language exposure and Mandarin input. This is likely due to a limited number of observations for the dummy variable “professional advice on language exposure”, as only two participants reported they were suggested by professionals to speak to their child by using only English at home. Results indicated that parent self-reported English proficiency was significantly associated with amount of Mandarin input in a negative relationship ($B = -2.73, p < .01$). Therefore, autism severity and professional advice did not predict greater reductions in Mandarin input; however, parents with higher English proficiency tended to reduce their child’s exposure to Mandarin in greater amount.

Table 3*Summary of Multiple Regression Analysis for Professional Advice and Autism Severity Predicting Heritage Language Exposure*

Variables	Coefficient		<i>Adjusted R-Squared</i>	<i>F</i>	<i>p-value</i>
	<i>B</i>	<i>SE (B)</i>			
Socioeconomic status	5.94	3.02	.26	2.16	.08
Parent English proficiency	-2.73**	.82			
Parent attitude toward bilingualism	.95	3.02			
Child gender	-17.61	9.55			
Child age	-.21	.33			
Service hours	-.01	.01			
Advice on language exposure	-24.75	15.29			
Autism severity	.04	.13			

* $p < .05$, ** $p < .01$, *** $p < .001$.

Although data in this sample did not substantiate the hypotheses on autism severity and professional advice influencing Mandarin exposure, large reductions in Mandarin input were indeed reported by parents after the child receiving an autism diagnosis. Acknowledging that obtaining an autism diagnosis may be an important predictor for such reductions, a *post hoc* repeated-measures *ANOVA* was conducted to determine whether autism severity affected the amount of reductions (Table 4). Findings suggested that significant reductions were observed in Mandarin input after the child received an autism diagnosis ($F = 49.51, p < .001$), across all levels of autism severity (Figure 3). Because increases in English service hours accounted for about 60% of decreases in Mandarin input, the remainder proportion of reductions was likely caused by decreased use of Mandarin in the home setting. This result indicated that parents chose to speak more English to their child at home after autism diagnosis, and this shift in home language environment holds true for parents of children with mild, moderate, and profound autism symptoms.

Table 4

Summary of Repeated Measures ANOVA for Mandarin Exposure

Source	Mandarin exposure			
	<i>df</i>	<i>F</i>	<i>p</i> -value	η^2
Between-subjects effects				
Autism severity	3	.40	.76	.04
Error	26			
Within-subjects effects				
Presence of ASD diagnosis	1	49.51	.00***	.66

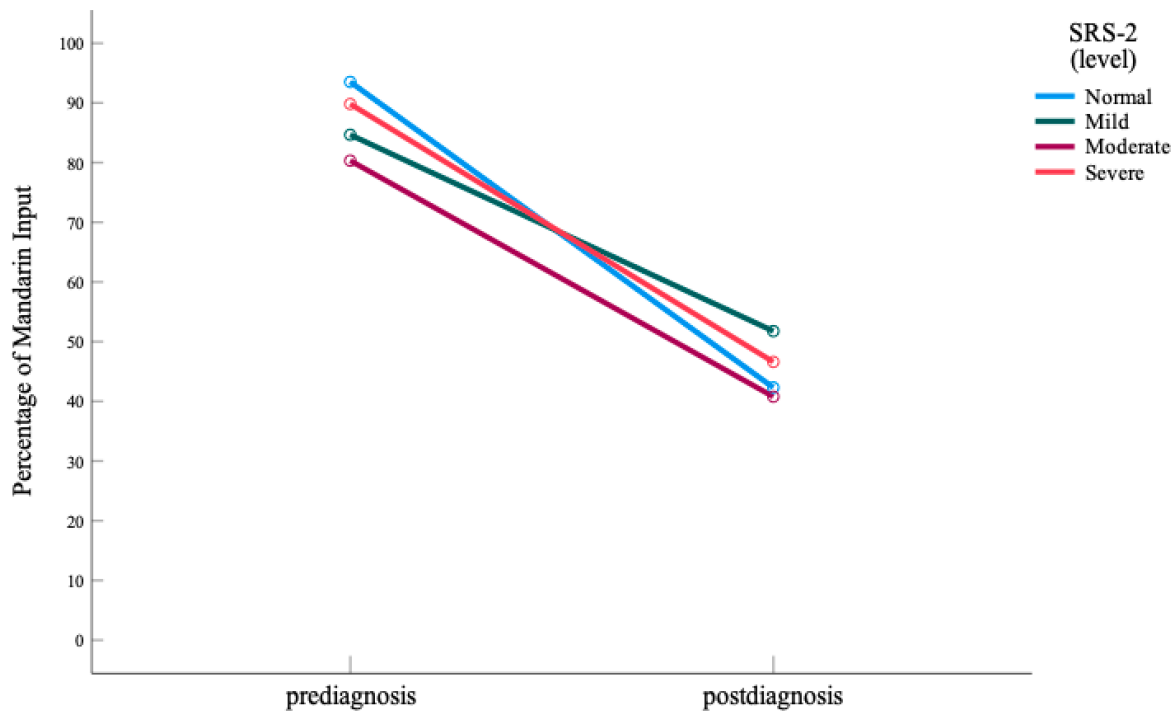
Table 4 (continued).

Source	Mandarin exposure			
	<i>df</i>	<i>F</i>	<i>p</i> -value	η^2
Presence of ASD diagnosis	3	.31	.82	.03
*Autism severity				
Error	26			

* $p < .05$, ** $p < .01$, *** $p < .001$

Figure 3

Reductions in Mandarin Input After Autism Diagnosis Affected by Autism Severity



Note. SRS-2 represents scores on Social Responsiveness Scale-2nd edition which indicates autism severity levels

Duration of Toy Engagement, Frequency of Communication Acts and Parent Verbal Responsiveness

To answer the third research question regarding whether there is a difference in duration of toy engagement and frequency of communication acts between English condition and Mandarin condition, a paired sample *t*-test analysis was conducted (Table 5). Results suggested that children emitted higher rates of communication bids during the English condition ($t = 4.08$, $p < .001$), whereas no significant difference was observed in duration of toy engagement between language conditions ($t = 1.92$, $p = .07$). Through the coding process, the researcher found children sometimes codeswitched to English in the Mandarin condition, which possibly reflected that speaking Mandarin was more effortful and might have generated less reinforcement in recent learning history. An alternative explanation may be some parents served as a discriminative stimulus for English due to more frequent use of English at home following autism diagnosis. The phenomenon of linguistic codeswitching may partially account for the differences in rates of communication bids between language conditions.

To address the fourth and fifth research questions on whether the levels of parent verbal responsiveness differ in two language conditions controlling for child behavior, indicators of verbal responsiveness were transformed to proportions of parent verbal responses to child's attentional focus or communication bids. Two paired sample *t*-test analyses were conducted comparing English and Mandarin (Table 6). Findings demonstrated that contingent on the child's attentional focus during object play, parents responded with significantly lower rates in the form of follow-in comments and follow-in directives in the English condition ($t = -2.87$, $p < .01$; $t = -3.80$, $p < .001$), whereas they responded with significantly higher rates in the form of question asking in the English condition ($t = 3.48$, $p < .01$) compared to the Mandarin condition. There

were no differences in the rates of verbal responsiveness (i.e., linguistic mapping, repeat, expansion, respond with a question, acknowledgement) following the child's communication bids in English compared to Mandarin.

Language Exposure, Language Quality and Bilingual Competence

To answer the last research question regarding the relationship between language exposure, language quality and bilingual competence, two series of multiple regression analyses were performed with other covariates being considered (Table 7, Table 8). The amount of Mandarin expressive vocabulary was treated as the dependent variable in the first series (Table 7). Because this research question is exploratory in nature, each language quality indicator was evaluated in a separate regression model. Results are presented with a priority to demonstrate whether previous evidence on follow-in comments and directives and expansions positively affecting language acquisition (McDuffie & Yoder, 2010) still holds for the current sample. Other significant language quality indicators contributing to language competence were also displayed in Table 7. Consistent with previous evidence (Hambly & Fombonne, 2014) and the researcher's assumption, amount of language input was an important predictor in each regression model, with greater exposure to Mandarin after receiving an autism diagnosis associating with larger vocabulary size in Mandarin. In terms of parent language quality, greater proportion of follow-in comments contingent on the child's attentional focus were linked to larger vocabulary size in Mandarin ($B = 6.93, p < .001$), which was line with the results from prior literature. The use of follow-in directives on the other hand, did not associate with expressive vocabulary size in Mandarin. Additionally, greater proportion of expansions did not link to larger vocabulary size, whereas greater proportion of repeats associated with larger vocabulary size in Mandarin ($B = 3.06, p < .01$).

Table 5*Mean Differences in Toy Engagement and Communication Acts*

	<i>Mean</i>	<i>SD</i>	<i>SE</i>	Paired <i>t</i> test		
				<i>t</i>	<i>df</i>	<i>p</i> -value
Engaged intervals						
English	50.25	7.97	1.45	1.92	29	.07
Mandarin	46.82	11.48	2.10			
Communication acts						
English	13.57	6.48	1.18	4.08	29	.00***
Mandarin	8.36	4.70	.86			

* $p < .05$, ** $p < .01$, *** $p < .001$

Table 6*Mean Differences in Parent Verbal Responsiveness to the Child's Attentional Focus and Communication Acts*

	<i>Mean</i>	<i>SD</i>	<i>SE</i>	<i>Paired t test</i>		
				<i>t</i>	<i>df</i>	<i>p-value</i>
Verbal Statement Contingent on Attentional Focus						
Follow-in comment						
English	36.90	16.00	2.67	-2.87	29	.01**
Mandarin	45.23	16.05	2.93			
Follow-in directive						
English	11.50	10.30	1.88	-3.80	29	.00***
Mandarin	20.27	11.83	2.16			
Questions						
English	28.28	16.86	3.08	3.48	29	.00**
Mandarin	20.39	13.80	2.52			
Verbal Statement Contingent on Communication						
Linguistic mapping						
English	11.60	23.86	4.36	.74	29	.46

Table 6 (continued).

	<i>Mean</i>	<i>SD</i>	<i>SE</i>	Paired <i>t</i> test		
				<i>t</i>	<i>df</i>	<i>p</i> -value
Mandarin	7.79	17.62	3.22			
Repeat						
English	29.41	22.36	4.08	-.47	29	.64
Mandarin	31.80	27.07	4.94			
Expansion						
English	14.95	15.46	2.82	.10	29	.92
Mandarin	14.55	15.02	2.74			
Respond with a question						
English	25.25	23.20	4.24	-.12	29	.90
Mandarin	25.91	24.59	4.49			
Acknowledgement						
English	6.90	11.46	2.09	-1.80	29	.08
Mandarin	13.78	21.96	4.01			

* $p < .05$, ** $p < .01$, *** $p < .001$

Table 7*Summary of Multiple Regression Analysis for Mandarin Exposure and Language Quality for Mandarin Vocabulary*

Variable	Model 1		Model 2		Model 3		Model 4	
	Follow-in comment		Follow-in directive		Expansion		Repeat	
	<i>B</i>	<i>SE (B)</i>	<i>B</i>	<i>SE (B)</i>	<i>B</i>	<i>SE (B)</i>	<i>B</i>	<i>SE (B)</i>
SES	41.59	25.56	27.87	28.06	33.04	29.06	26.26	25.80
Child age	2.57	2.97	3.11	3.33	3.42	3.33	4.48	3.10
Child gender	8.64	79.73	20.33	90.06	52.60	91.16	54.36	82.81
Autism severity	-2.13	1.18	-3.40*	1.34	-2.66	1.31	-2.10	1.24
Service hours	.32**	.12	.30*	.14	.26	.14	.19	.13
Mandarin exposure after diagnosis	7.34***	1.86	5.59**	1.93	4.67*	1.88	5.19**	1.71
Language quality indicator	6.93**	2.59	4.00	3.66	2.89	2.78	3.06*	1.36
Adjusted R ²	.48**		.35*		.34*		.44**	

* $p < .05$, ** $p < .01$, *** $p < .001$

The number of English expressive vocabulary words was treated as the dependent variable in the second series (Table 8). Results showed that greater exposure to English from birth to the time of assessment contributed to larger vocabulary size in English. In contrast with previous evidence (McDuffie & Yoder, 2010), neither follow-in comments nor follow-in directives were significantly associated with English expressive vocabulary. Expansions contingent on the child's communication acts significantly contributed to English vocabulary size ($B = 4.25, p < .05$), which was in accordance with prior literature. In addition, the researcher found that "responding in the form of a question" with an intention to elicit a verbal response from the child also linked to larger English vocabulary size ($B = 4.92, p < .001$).

To evaluate the amount of the effect the independent variables generated, each language exposure variable and language quality indicator were introduced into regression analyses in a stepwise fashion (Table 9). Results demonstrated that Mandarin exposure accounted for 18% of the variation in Mandarin vocabulary size, while follow-in comment and repeat explained 14% and 10% of the variances in Mandarin expressive vocabulary respectively. Amount of English exposure accounted for 12% of the variance in English vocabulary size, while expansion and "responding with a question" explained 9% and 28% of the variances in English expressive vocabulary correspondingly.

Table 8*Summary of Multiple Regression Analysis for English Exposure and Language Quality for English Vocabulary*

Variable	Model 1		Model 2		Model 3		Model 4	
	Follow-in comment		Follow-in directive		Expansion		Respond with a question	
	<i>B</i>	<i>SE (B)</i>	<i>B</i>	<i>SE (B)</i>	<i>B</i>	<i>SE (B)</i>	<i>B</i>	<i>SE (B)</i>
SES	18.14	23.67	13.65	22.77	12.58	20.32	11.31	15.95
Child age	4.36	2.88	5.27	2.86	4.90	2.41	5.76**	1.91
Child gender	55.33	68.78	73.75	70.36	78.38	60.76	24.43	47.85
Autism severity	-2.56*	1.03	-2.51*	1.02	-3.17**	.96	-.97	.81
Service hours	.16	.12	.13	.12	.20	.11	.01	.09
English exposure overall	4.58*	1.92	4.74*	1.93	3.95*	1.76	3.63*	1.38
Language quality indicator	-.54	2.41	-2.25	3.59	4.25*	1.90	4.92***	1.07
Adjusted R ²	.40**		.41**		.51***		.70***	

* $p < .05$, ** $p < .01$, *** $p < .001$

Table 9*Change of Variances Explained in Expressive Vocabulary Size by Adding Language Quantity and Language Quality Variable*

Language	Predictor variable	Adjusted R ²	Adjusted R ² change	F change	Sig. F change
Mandarin	Covariates	.16	.16	2.08	.11
	Amount of exposure	.34	.18	3.39	.02
Model 1	Follow-in comment	.48	.14	4.75	.00
Model 4	Repeat	.44	.10	4.16	.01
English	Covariates	.30	.30	3.42	.02
	Amount of exposure	.42	.12	4.43	.00
Model 3	Expansion	.51	.09	5.12	.00
Model 4	Respond with a question	.70	.28	10.28	.00

Note. For Mandarin vocabulary size, model 1 predictors include covariates and language quality indicator: follow-in comment; model 4 predictors include covariates and language quality indicator: repeat. For English vocabulary size, model 3 predictors comprise covariates and language quality indicator: expansion; model 4 predictors comprise covariates and language quality indicator: respond.

CHAPTER IV

DISCUSSION

This study suggests that professional advice and autism severity were not significantly related to amount of reductions in heritage language exposure. Caregivers reduced their use of Mandarin in home environment after diagnosis regardless of the severity levels of their child's autism symptoms. Language exposure accounted for significant variations in bilingual outcomes with higher amount of exposure to each language contributing to larger expressive vocabulary size in each language. The findings reflected that parents' use of follow-in comment and repeat contributed to Mandarin expressive vocabulary, while expansion and question asking contributed to English expressive vocabulary.

Main Findings and Implications for Practice

Factors Influencing Caregivers' Decisions About the Language Environment

The first goal of the study was to examine the contributing factors for amount of dual language exposure. Results of the present study suggested that professional advice and autism severity were not significantly related to amount of reductions in heritage language exposure, despite that these were crucial factors for changes in language environment revealed by previous qualitative interviews and descriptive studies (Hampton et al., 2017; Paradis et al., 2018). It is noteworthy that only two caregivers in this study reported they received advice to restrict language input to English, whereas 28 adult participants received pro bilingual advice from professionals. Limited observations on this dummy variable may render the statistical effect nonsignificant, but this phenomenon reflects a potential positive shift in professional's conduct to make recommendations based on empirical evidence rather than myths and stereotypes of bilingualism. Additionally, this is the first study in the Chinese American community to explore

the effect of autism severity on amount of reductions in heritage language input. Extant evidence suggested that children with lower functioning level and low verbal ability experienced a greater shift in language environment and loss in bilingual input (Hambly & Fambonne, 2014; Hampton et al., 2017; Yu, 2018), but all children in this study experienced a similar level of reduction in Mandarin input. Caregivers reduced their use of Mandarin in home environment regardless of the severity levels of their child's autism symptoms.

Although recognizing that bilingual exposure does not cause further language delay, Chinese American caregivers spoke less Mandarin at home after the child's receipt of an autism diagnosis. Anecdotally, caregivers in the current sample expressed an urgent need to help their child generalize and maintain newly acquired skills from intervention, and a cost of Mandarin loss was expected and perceived as reasonable by caregivers. This observation aligns with prior qualitative evidence that most Chinese American caregivers stated English is more important compared to Chinese because English proficiency leads to school success (Yu, 2013). On a broader scope, the vitality and social status of Chinese language in the U.S. context may impede caregivers' consistent efforts in retaining the heritage language. Unlike the previous study conducted with participants residing in Québec, Canada where both English and French are recognized as national languages (Hambly & Fambonne, 2014), Chinese language was rated as "developing" in the U.S. (Ethnologue Global Dataset, 2022). A "developing" language status indicates Chinese is in vigorous use with standardized linguistic systems, but the dissemination is restricted for intergroup communication among Chinese cultural communities (Ethnologue Global Dataset, 2022). Chinese language has not been widely used for cross-group communication, in mass media, at institutionally supported education or workplaces. When Chinese American caregivers make decisions regarding how to construct home language

environment, both the immediate (i.e., achieve optimal intervention efficacy) and delayed reinforcement contingencies (i.e., success in education and employment opportunities) in the natural environment may not support a bilingual choice.

The finding of caregivers reducing Mandarin input despite receiving pro bilingual advice from professionals sheds light on the complexity of language exposure choices. The practical issues with language status and cultural values for achieving school success might take greater precedence in Chinese American parents' decision making. Parent's English proficiency may also play a role in language exposure choices, with higher proficiency related to more frequent use of English. It is noteworthy that social impairment did not significantly impact the child's basic bilingual competence, given the condition of receiving adequate bilingual input. Therefore, parents of children with mild, moderate, and profound autism may all make ongoing changes in home language environment based on their child's progress in language acquisition, i.e., parents may speak more Mandarin as their child's English proficiency increases (Yu, 2016). Language exposure choice is dynamic and influenced by a variety of factors. Practitioners working with linguistically diverse families need to be prepared with general empirical evidence on dual language exposure, which may not directly influence parents' language output but can alleviate their reservations and anxiety toward heritage language use (Paradis et al., 2018). Professionals should also acknowledge the necessity to provide individualized guidance for families based on their cultural values, personal values, and family characteristics. An understanding of caregivers' concerns regarding their own English language proficiency, a desire for the child's school success and child's autism severity may lead to more effective guidance on how to optimize home language environment.

Contributing Factors to Early Bilingual Competence in Chinese American Children with ASD

Language Exposure and Bilingual Competence. The focus of the present study was to examine the relationship between language quantity and quality and child's bilingual acquisition. Regarding quantity of dual language exposure, findings suggested that language exposure accounted for significant variations in bilingual outcome with higher amount of exposure to each language contributing to larger expressive vocabulary size in each language. This result is in line with prior empirical evidence that the amount of language exposure is essential for basic and complex linguistic abilities among autistic bilingual children (Gonzalez-Barrero & Nadig, 2018; Kay-Raining Bird et al., 2016). Particularly, amount of Mandarin exposure after autism diagnosis significantly predicted Mandarin vocabulary size, whereas English exposure from birth to the present predicted English vocabulary size. This finding reflected that speaking to the child with Mandarin in an adequate amount after receiving an autism diagnosis was a prerequisite for continuing growth in heritage language competence, whereas language restriction will lead to heritage language loss in the long term (Paradis et al., 2018). Although the criterion for "adequate amount of exposure" is understudied in the literature, children in this sample heard Mandarin for about four to five hours per day which seems necessary to lay a foundation for bilingualism at this age (Nagpal & Nicoladis, 2017).

Consistent with extant evidence (Hambly & Fambonne, 2014; Paradis et al., 2018), vocabulary size in the society language was positively correlated with number of expressive vocabularies in heritage language, indicating the underlying mechanisms for acquiring two languages are common: NVIQ and level of social impairment (Thurm et al., 2017; Wodka et al., 2012). In addition, although Mandarin and English have distinct linguistic systems, they do have overlapped linguistic features. There are many English loanwords in Chinese lexicon, and phonological awareness and decoding skills in these two languages are positively correlated

(Yan & Deng, 2009; Yang et al., 2017). Shared linguistic features may allow for transfer in learning between Mandarin and English. Although the amount of transfer remains understudied in the autistic population (Kay-Raining Bird et al., 2016), exposure to Mandarin could also be beneficial to English acquisition and vice versa.

Professionals need to be informed with the fact that amount of language exposure is essential for retaining heritage language. Specifically, if caregivers want to raise their child to be bilingual, then adequate exposure to Mandarin is crucial in contexts where English is the majority language like the US. Additionally, professionals can be more confident when facing caregivers of children with profound autism: that autistic children with severe social impairment are capable of basic communication skills in two languages if sufficient learning opportunities are provided in the environment. Given that the intensity and quality of social interaction in home language is likely to be lower compared with English language used in intervention, greater amount of input might be required to keep Mandarin alive. Increasing the quality of social interactions is another aspect to retain Mandarin language that will be discussed in the following section.

Language Quality Indicators and Bilingual Competence. The primary focus of this study lies in the relationship between caregivers' language quality and the child's bilingual competence, as the main goal of the study is to support early intervention professionals in empowering parents of autistic children with linguistically diverse background. The findings reflected that follow-in comments and repeats contributed to Mandarin expressive vocabulary, while expansion and question asking contributed to English expressive vocabulary, with autism severity, amount of language exposure and other covariates (i.e., SES, child's age and gender, hours of professional services) being held constant. These findings align with those of Siller and

Sigman (2003) and McDuffie and Yoder (2010), who demonstrated that parents' verbal responsiveness and synchronization facilitated early language acquisition in monolingual autistic children. This study adds to extant literature by revealing that different aspects of parent verbal responsiveness may play a different role in the child's bilingual outcomes. But it is counterintuitive to interpret the finding in this way, as follow-in comments and directives, language repeats, expansions and question asking ought to be beneficial for language acquisition despite which language it is.

These findings suggest that Chinese American caregivers have different strength areas when using different languages to interact with their child. Chinese American caregivers displayed strengths in using comments and repeats in Mandarin, whereas they were stronger at using language expansions and embedding questions in English when playing with their child. Factors such as dissimilar linguistic systems, longer learning history with Mandarin, deeper Chinese cultural immersion and recent involvement in the child's English services may shape parents' language quality in different ways (Smith et al., 2020; Yang et al., 2017). For instance, parents' recent involvement in the child's professional services in English may play a role in using expansions and embedding questions during play. On the other hand, the application of follow-in comments requires higher fluency, diversity, and flexibility with language use. Chinese American caregivers may have greater difficulty commenting on their child's attentional focus due to lack of shared childhood experiences or longer latency of recalling appropriate vocabularies (Yu, 2016). Additionally, it can be more challenging to conduct proper language expansions in Mandarin compared with in English language. In English, if a child with a mean length of utterance of one word is holding a car, caregiver can choose from diverse ways to expand: "fast car", "car goes", "drive a car" etc. But the morphological system in Mandarin

makes it difficult to add morphemes in a developmentally appropriate manner, e.g., “car crashes” does not convey clear and complete meaning so that “car crashes into a tower” may need to be used. However, children might not be receptive and pick up this expansion in play as the language used greatly exceeds their developmental level.

This finding also complements those of Smith et al. (2020) and Hudry et al. (2018) who found differences presented in parent verbal responsiveness across heritage and societal language, but these authors did not further address the associations between parent language quality and the child’s bilingual outcomes. The results from the present study were in contrast with prior evidence (Hudry et al., 2018; Smith et al., 2020) in a sense that Chinese American caregivers demonstrated different strengths areas in heritage and societal language, whereas caregivers in the previous sample recruited in Melbourne, Australia only demonstrated strengths in the societal language. Chinese American caregivers had similar acculturation history with the sample recruited in Australia as both groups of caregivers were born in their home country and immigrated to a different country for about a decade ago. But Chinese American caregivers in the current sample had high income and high educational level, which might lead to divergent experiences interacting with the dominant culture and distinct changes in parenting behavior after involvement in the child’s intervention services.

When early intervention professionals provide coaching for bilingual caregivers, it is optimal to start with assessments of the child’s communication in both languages and followed by collaborative goal planning with caregivers’ cultural and personal values being considered (Drysdale et al., 2015). Providing effective parent coaching on language strategies may require a certain level of bilingual proficiency from professionals, depending on individual family characteristics. Acknowledging that intervention strategies practiced in one language may not

naturally generalize to the other, targeted support may be necessary in that language. For professionals working with Chinese American caregivers, follow-in comments and directives are important targets to work on in English language. Conducting language expansions is particularly important to foster in parents' use of Mandarin language. Professionals can maximize services by coaching these specific skills in the corresponding language condition, conduct generalization probes in the other language, and provide booster training if generalization does not naturally occur (i.e., multiple exemplar training, programming common stimuli et.; Stokes & Baer, 1977). For some caregivers, providing modeling and self-management strategies may be sufficient to generate positive outcomes in their behavior during play (Schreibman & Koegel, 2005). Depending on caregivers' language proficiency in English and learning history with play intervention, the dosages of coaching required to make an impact in parent and child outcomes can also differ (Magaña et al., 2021). The dosage and efficacy of bilingual parent coaching warrants further research.

Limitations and Future Research

Study findings should be interpreted with caution due to several limitations in recruitment of participants and research methodology. First, although the researcher endeavored to recruit participants with diverse SES backgrounds from multiple social media platforms, most adult participants in this study were high-income and high-education individuals live in developed areas in the U.S. The sample was biased toward high-SES Chinese American caregivers, which limits the generalizability of study results. For example, professionals interacted with low-SES caregivers may be less equipped with empirical evidence on bilingualism and autism, and therefore more likely to provide advice against a bilingual approach. Additionally, English proficiency was not a significant factor to influence the language quality among high-education

caregivers, but inadequate English is likely to reduce quality of parent-child interaction for caregivers with low educational levels. Chinese American immigrants are a highly heterogeneous group with within-group differences that need to be considered when working with families with different backgrounds (Magaña et al., 2021). Future researchers should make efforts to recruit a larger sample of demographically diverse participants so that the associations between within-group heterogeneity and bilingual outcomes can be detected more comprehensively.

Methodological limitations may have also impacted study results. For instance, a sample size of 30 was estimated through conducting a power analysis based on previous evidence on amount of language exposure and language outcome (Hambly & Fambonne, 2014). But the effect sizes of other variables (e.g., advice regarding bilingualism on language exposure, language quality indicators on bilingual outcomes) were unknown and a much larger sample size might be required to detect significant effects of these factors. Furthermore, the outcome measures to assess bilingual outcomes in this study (MacArthur-Bates Communicative Development Inventories; Fenson et al., 2006; Tardif & Fletcher, 2008) relied on retrospective parent report. Although ECDI-WS and MCDI-WS are valid and reliable language assessment tools in English and Mandarin, a retrospective methodology may result in inaccurate assessment results. For example, a child participant has not used Mandarin to communicate with his mother for several months, therefore the mother was unconfident about whether the words reported are still in the child's communication repertoire. Similar issue occurs for a child who only spoke English with therapists and in intervention settings. The parent had to communicate with the child's therapists to obtain more precise assessment of English expressive vocabulary, however the precision of therapists' report may vary based on duration of services provided for the child. Future research should conduct direct observations of the child's bilingual communication

competence by using culturally adapted and validated assessment tools, for example the receptive and expressive subscales in Mullen Scales of Early learning (Cheong et al., 2022). Another barrier a lack of understanding regarding how to treat uncommon vocabularies used by children with ASD. Most standardized language assessments do not take unusual words into consideration, however many children with ASD develop a fair number of uncommon words due to circumscribed interests in play and social interaction. For example, several children in this sample can name a wide range of dinosaurs, vehicles, planets, or chemical elements. These words can also be used in functional ways in some social situations. Whether and how to weigh these words against common words in the evaluation of the child's expressive vocabulary should be discussed by future research.

Additionally, a few child participants with high verbal ability in this sample demonstrated emerging codeswitching behaviors during play interactions. Switching between languages in a linguistically appropriate and socially meaningful manner during conversations is an indicator of communicative competence (Almelhi, 2020). Yu (2016) utilized in-depth conversational analysis with a boy with ASD and summarized functions of codeswitching: emphasis and clarification and making a polite request. Yu (2016) also noted that compared with the boy's typically developed sibling, the boy did not display "embedding" which means quoting another individual's utterances in one language and embed it in one's own conversation which is predominately in the other language. The prerequisite skill for embedding may include advanced working memory and perspective taking, which tend to be impaired in children with ASD (Berenguer et al., 2017). In our sample, child participants more frequently displayed codeswitching in the Mandarin condition, which may be due to lack of Mandarin vocabularies to draw from or more effortful lexical retrieval (Luk & Bialystok, 2013). It seems child participants

in this sample used codeswitching to remediate language deficits rather than to enhance the effectiveness of social interaction. Future researchers should conduct conversational analyses to find out systematic patterns and illustrate how the functions and rates of codeswitching may be indicative of language competence among autistic children.

Finally, although the researcher intended to suggest a predictive relationship between amount of language exposure, language quality indicators and the child's bilingual outcomes, the study was conducted by using a cross-sectional design. Longitudinal research is essential to obtain accurate predictions on bilingual competence.

Conclusion

In sum, the current study evaluated the effect of amount of dual language exposure and parents' language quality on bilingual competence for Chinese American children with ASD. This study provided an enhanced understanding of how to provide supports regarding constructing language environment and improving quality of parent-child play interactions for culturally and linguistically diverse families.

APPENDIX A

DEMOGRAPHICS AND BACKGROUND SURVEY

Parent Information:

1. Where do you live?

City (county): _____

2. Please indicate your relationship to child

Mother Father Grandparent Other (please specify): _____

3. Who is the child's primary caregiver?

Mother Father Grandparent Other (please specify): _____

4. What is your marital status? If you are a grandparent of the child, please indicate child's parents' marital status

Never married Married Widowed Divorced Separated Engaged

5. How old are you? _____

Mother: _____

Father: _____

6. What is your educational level? _____

Some school but no high school or GED equivalent

High school degree or equivalent

Professional Training

Some college, no degree

Bachelor's degree

Master's degree

Doctorate (Ph.D./M.D./J.D.)

Mother: (skip if you are the mother)

Less than high school

High school degree or equivalent

Professional Training

Some college, no degree

Bachelor's degree

Master's degree

Doctorate (Ph.D./M.D./J.D.)

Father: (skip if you are the father)

Less than high school

High school degree or equivalent

Professional Training

Some college, no degree

Bachelor's degree

Master's degree

Doctorate (Ph.D./M.D./J.D.)

7. (a) What best describes your employment status?

Employed full time Employed half time Retired Unemployed

(b) What is your occupation? _____

Mother: _____

Father: _____

8. What is your household income?

- 0-\$20,000
 \$20,001-\$34,999
 \$35,000-\$49,999
 \$50,00-\$74,999
 \$75,000-\$99,999
 \$100,000+

9. 1) Have you received any training in during the past 6 months regarding autism intervention?

- Yes No

2) What specific topic areas have you learnt about autism intervention?

Social communication Play Challenging behavior Sleep difficulty Toilet training Other areas (please specify): _____

3) What language did you receive the training in?

- English Mandarin Both

4) How many hours of training did you receive in English on social communication and play during the past 6 months?

5) How many hours of training did you receive in Mandarin on social communication and play after your child receiving an autism diagnosis?

10. Please indicate your language preference to communicate with your child.

- English Mandarin Combination of English and Mandarin

11. Do you want your child to develop language skills in Mandarin Chinese?

- Yes No

12. Have you received any professional advice to restrict home language input to mostly English or English only?

- Yes No

13. 1) What language mother speaks to the child:

English never, Mandarin always English seldom, Mandarin usually English 50%, Mandarin 50% English usually, Mandarin seldom English almost always, Mandarin almost never

2) What language father speaks to the child:

English never, Mandarin always English seldom, Mandarin usually English 50%, Mandarin 50% English usually, Mandarin seldom English almost always, Mandarin almost never

3) What language siblings speak to the child:

English never, Mandarin always English seldom, Mandarin usually English 50%, Mandarin 50% English usually, Mandarin seldom English almost always, Mandarin almost never

4) What language extended family members (e.g., grandparents) speak to the child:

English never, Mandarin always English seldom, Mandarin usually English 50%, Mandarin 50% English usually, Mandarin seldom English almost always, Mandarin almost never

14. 1) What language your child speaks to mother:

English never, Mandarin always English seldom, Mandarin usually English 50%, Mandarin 50% English usually, Mandarin seldom English almost always, Mandarin almost never

2) What language your child speaks to father:

English never, Mandarin always English seldom, Mandarin usually English 50%, Mandarin 50% English usually, Mandarin seldom English almost always, Mandarin almost never

3) What language your child speaks to siblings:

English never, Mandarin always English seldom, Mandarin usually English 50%, Mandarin 50% English usually, Mandarin seldom English almost always, Mandarin almost never

4) What language your child speaks to extended family members:

English never, Mandarin always English seldom, Mandarin usually English 50%, Mandarin 50% English usually, Mandarin seldom English almost always, Mandarin almost never

Child Information:

1. How old is your child? _____

2. Child gender: _____

3. How old was your child when they received the autism diagnosis? _____

4. What services have your child received?

Speech-language therapy Occupational therapy ABA therapy Other services (please specify): _____

5. How many hours of intervention and services your child received during the past 6 months?

6. At what age did your child start to learn English?

2) At what age did your child start to learn Mandarin?

7. 1) How well does your child speak English compared bilingual children with similar age?

0	1	2	3	4	5	6	7	8	9	10
None	Very low	Low	Fair	Slightly less than adequate	Adequate	Slightly more than adequate	Good	Very good	Excellent	Perfect

2) How well does your child speak Mandarin?

0	1	2	3	4	5	6	7	8	9	10
None	Very low	Low	Fair	Slightly less than adequate	Adequate	Slightly more than adequate	Good	Very good	Excellent	Perfect

APPENDIX B

LANGUAGE EXPERIENCE AND PROFICIENCY QUESTIONNAIRE (LEAP-Q)

Last name		First name		Today's Date	
Age		Date of Birth		Male <input type="checkbox"/>	Female <input type="checkbox"/>

(1) Please list all the languages you know **in order of dominance**:

1	2	3	4	5
---	---	---	---	---

(2) Please list all the languages you know **in order of acquisition** (your native language first):

1	2	3	4	5
---	---	---	---	---

(3) Please list what percentage of the time you are *currently* and *on average* exposed to each language. *(Your percentages should add up to 100%)*:

List language here:					
List percentage here:					

(4) When choosing to read a text available in all your languages, in what percentage of cases would you choose to read it in each of your languages? Assume that the original was written in another language, which is unknown to you. *(Your percentages should add up to 100%)*:

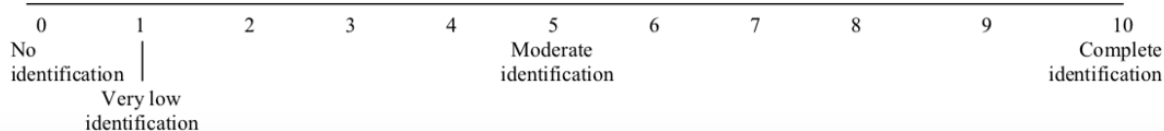
List language here:					
List percentage here:					

(5) When choosing a language to speak with a person who is equally fluent in all your languages, what percentage of time would you choose to speak each language? Please report percent of total time. *(Your percentages should add up to 100%)*:

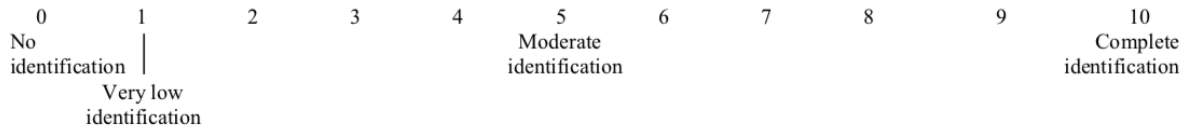
List language here					
List percentage here:					

(6) Please name the cultures with which you identify. On a scale from zero to ten, please rate the extent to which you identify with each culture. (Examples of possible cultures include US-American, Chinese, Jewish-Orthodox, etc.):

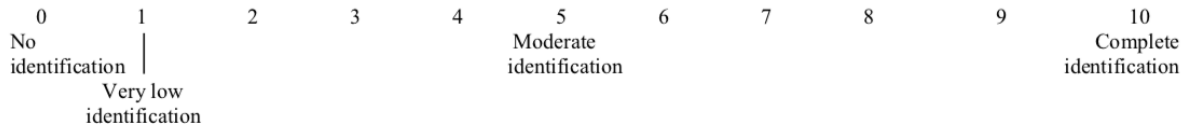
Culture: _____



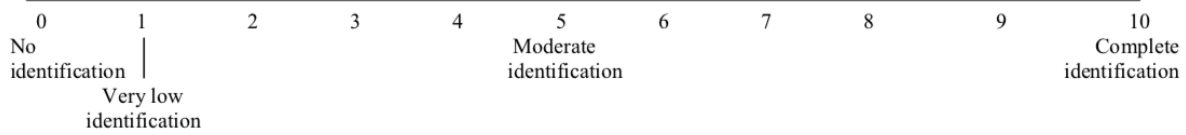
Culture: _____



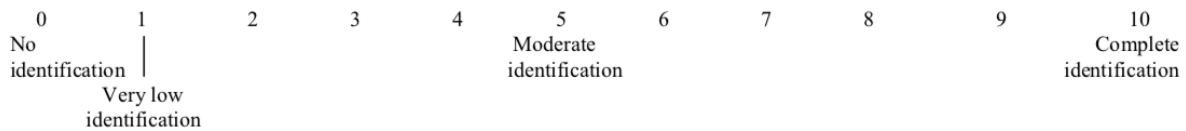
Culture: _____



Culture: _____



Culture: _____



(7) How many years of formal education do you have? _____

Please check your highest education level (or the approximate US equivalent to a degree obtained in another country):

- | | | |
|--|---|--|
| <input type="checkbox"/> Less than High School | <input type="checkbox"/> Some College | <input type="checkbox"/> Masters |
| <input type="checkbox"/> High School | <input type="checkbox"/> College | <input type="checkbox"/> Ph.D./M.D./J.D. |
| <input type="checkbox"/> Professional Training | <input type="checkbox"/> Some Graduate School | <input type="checkbox"/> Other: |

(8) Date of immigration to the USA, if applicable _____

If you have ever immigrated to another country, please provide name of country and date of immigration here.

(9) Have you ever had a vision problem , hearing impairment , language disability , or learning disability ? (Check all applicable).

If yes, please explain (including any corrections):

Language:

This is my (**native second third fourth fifth**) language.

(1) Age when you...

<i>began acquiring this language:</i>	<i>became fluent in this language:</i>	<i>began reading in this language:</i>	<i>became fluent reading in this language:</i>

(2) Please list the number of years and months you spent in each language environment:

	Years	Months
A country where this language is spoken		
A family where this language is spoken		
A school and/or working environment where this language is spoken		

(3) Please circle your *level of proficiency* in speaking, understanding, and reading in this language:

Speaking

0	1	2	3	4	5	6	7	8	9	10
None	Very low	Low	Fair	Slightly less than adequate	Adequate	Slightly more than adequate	Good	Very good	Excellent	Perfect

Understanding spoken language

0	1	2	3	4	5	6	7	8	9	10
None	Very low	Low	Fair	Slightly less than adequate	Adequate	Slightly more than adequate	Good	Very good	Excellent	Perfect

Reading

0	1	2	3	4	5	6	7	8	9	10
None	Very low	Low	Fair	Slightly less than adequate	Adequate	Slightly more than adequate	Good	Very good	Excellent	Perfect

(4) Please circle how much the following factors contributed to you learning this language:

Interacting with friends

0	1	2	3	4	5	6	7	8	9	10
Not a contributor	Minimal contributor				Moderate contributor					Most important contributor

Interacting with family

0	1	2	3	4	5	6	7	8	9	10
Not a contributor	Minimal contributor				Moderate contributor					Most important contributor

Reading

0	1	2	3	4	5	6	7	8	9	10
Not a contributor	Minimal contributor				Moderate contributor					Most important contributor

Language tapes/self-instruction

0	1	2	3	4	5	6	7	8	9	10
Not a contributor	Minimal contributor				Moderate contributor					Most important contributor

Watching TV

0	1	2	3	4	5	6	7	8	9	10
Not a contributor	Minimal contributor				Moderate contributor					Most important contributor

Listening to the radio

0	1	2	3	4	5	6	7	8	9	10
Not a contributor	Minimal contributor				Moderate contributor					Most important contributor

(5) Please circle to what extent you are currently exposed to this language in the following contexts:

Interacting with friends

0	1	2	3	4	5	6	7	8	9	10
Never	Almost Never				Half of the time					Always

Interacting with family

0	1	2	3	4	5	6	7	8	9	10
Never	Almost Never				Half of the time					Always

Watching TV

0	1	2	3	4	5	6	7	8	9	10
Never	Almost Never				Half of the time					Always

Listening to radio/music

0	1	2	3	4	5	6	7	8	9	10
Never	Almost Never				Half of the time					Always

Reading

0	1	2	3	4	5	6	7	8	9	10
Never	Almost Never				Half of the time					Always

Language-lab/self-instruction

0	1	2	3	4	5	6	7	8	9	10
Never	Almost Never				Half of the time					Always

(6) In your perception, how much of a foreign accent do you have in this language?

0	1	2	3	4	5	6	7	8	9	10
None	Almost none	Very light	Light	Some	Moderate	Considerable	Heavy	Very heavy	Extremely heavy	Pervasive

(7) Please circle how frequently others identify you as a non-native speaker based on your accent in this language:

0	1	2	3	4	5	6	7	8	9	10
Never	Almost Never				Half of the time					Always

APPENDIX C

LANGUAGE EXPOSURE ASSESSMENT TOOL (LEAT)

Participant ID: _____
 Today's Date: _____
 Date of Birth: _____
 Reporter: _____
 Age of child in months: _____

Primary Input by Person: "Who interacts with <child's name> on a regular basis?" (Regular basis = once per week)

Person	L1 (Primary Language)		L2 (Secondary Language)		L3 (Tertiary Language)		Notes
	Dialect/Region	Native?	Dialect/Region	Native?	Dialect/Region	Native?	

If using a language that is not Spanish and English use Other1, Other2, Other3, Other4 please specify:
 Other1: _____ Other3: _____
 Other2: _____ Other4: _____

Primary Input by Language and Person

Who/Situation	What Ages?		Sun	Mon	Tues	Wed	Thu	Fri	Sat	Language and Hours per day		
	from	to								L1 & Hours/day	L2 & Hours/day	L3 & Hours/day
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
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Notes/Trips:

PARENT ESTIMATE	
language	percent
Spanish	
English	
0	
0	
0	

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