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Bilingualism and Autism: A Summary of Current Research and Implications for Augmentative and Alternative Communication Practitioners

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Purpose: *The purpose of this article is to offer augmentative and alternative communication practitioners a review and summary of the current research on the topic of bilingualism and autism in order to inform their work with children on the autism spectrum in bilingual/multilingual contexts. Topics reviewed include studies comparing the developmental outcomes between monolingual and bilingual children on the autism spectrum and studies on the role of home language development in English acquisition.*

Conclusions: *The findings of the review suggest that developmental outcomes of bilingual and monolingual children on the autism spectrum are comparable. Findings also suggest that home language development is beneficial for English acquisition. Based on these findings, guidelines are offered to support the provision of augmentative and alternative communication services for children and families who speak languages other than or in addition to English.*

Autism is found around the world across boundaries of race/ethnicity, nationality, class, and geography. It is estimated that approximately 25% of individuals on the autism spectrum communicate nonverbally or using minimal language and would benefit from the communication support provided by augmentative and alternative communication (AAC). Understanding bilingualism in the context of autism and AAC is of great significance for service providers because more than half of the world's population lives in environments where more than one language is spoken (Crystal, 2018).

There are some common concerns that arise for families of children on the autism spectrum when they consider AAC use in a bilingual environment. *Bilingualism*, in this context, refers to the dynamic process in which at least two languages are used in an individual's life to some degree (American Speech-Language-Hearing Association, 2004). The purpose of this article is to offer practitioners a review and summary of the current research to answer two frequently asked questions on the topic of bilingualism and autism and to discuss the implications of the research findings for AAC practitioners. Specifically, the following questions will be addressed:

1. Does exposure to more than one language cause confusion and/or further developmental delays in children who are on the autism spectrum?
2. Because most educational and intervention programs are available only in English, should parents of children on the autism spectrum speak as much English as possible with the children so that they can benefit from these programs?

Following the review, practical guidelines will be provided to support the provision of AAC services for children and families who speak languages other than or in addition to English.

Monolingual Versus Bilingual Children on the Autism Spectrum

One of the most frequently cited concerns of parents and professionals is whether exposure to more than one language would cause children on the autism spectrum to be confused or to experience further developmental delays. Studies show that bilingual children on the autism spectrum perform just as well as monolingual children on the autism spectrum across a range of language, social, and cognitive measurements (see Drysdale, van der Meer, & Kagohara, 2015, for a review). Hambly and Fombonne (2012), for example, compared the social and language abilities of three groups of young children (36–78 months of age) on the autism spectrum, including those who were (a) exposed to one language, (b) exposed to two languages before 12 months of age (i.e., simultaneous bilinguals), and (c) exposed to two languages after 12 months of age (i.e., sequential bilinguals). In particular, they examined aspects of development associated with core challenges for children on the autism spectrum, including social responsiveness, initiation of and response to pointing, attention to voice, vocabulary size, age of first words, and age of first phrases. No significant differences were found between the bilingual and monolingual subjects or between simultaneous and sequential bilingual children. Furthermore, they observed that approximately 60% of the bilingually exposed children were acquiring vocabulary skills in both languages. The findings suggest that children on the autism spectrum are capable of becoming bilingual and that bilingualism does not negatively affect their learning and/or development.

The findings above were consistent with those of other studies, including that of Petersen, Marinova-Todd, and Mirenda (2012) who compared the language abilities of monolingual English-speaking young children on the autism spectrum with those of bilingual English/Chinese-speaking children with the same diagnosis on their performance on the Peabody Picture Vocabulary Test–III, the MacArthur–Bates Communicative Development Inventories, and the Preschool Language Scale–Third Edition. They found no significant difference between the two groups across these assessments. The bilingual children were observed to have larger total production vocabularies.

Ohashi et al. (2012) compared the communication abilities of French/English-speaking bilingual children on the autism spectrum with those of French- or English-speaking monolingual children on the autism spectrum who were matched by age and nonverbal IQ. The children were compared on the severity of their communication difficulties, age of first words/phrases, and receptive/expressive language scores as well as their functional communication scores across the Preschool Language Scale (Zimmerman, Steiner, & Pond, 2002) and the Vineland Adaptive Behavior Scales (Sparrow, Cicchetti, & Balla, 2005). Similar to the studies above, the findings show no significant differences between the two groups of children.

Valicenti-McDermott et al. (2013) conducted a retrospective review of speech and language evaluation results of young children on the autism spectrum from a university clinic. They found no significant differences between monolingual English-speaking and bilingual English/Spanish-speaking children on the autism spectrum across observed communication and language milestones (e.g., cooing/babbling, eye contact, gestures, pointing, pretend play, response to name, vocalizations, and following commands). They also found no differences between the two groups on their language performance on the Rossetti Infant–Toddler Language Scale (Rossetti, 1990) or performance in other developmental domains as indicated by the Childhood Autism Rating Scale (Schopler, Van Bourgondien, Wellman, & Love, 2010). Bayley Scales of Infant Development (Bayley, 2006), and Vineland Adaptive Behavior Scales (Sparrow et al., 2005).

Finally, Reetzke, Zou, Sheng, and Katsos (2015) studied the outcomes of bilingual versus monolingual children in China with a focus on their social communication and pragmatic performance. Using standardized parent questionnaires, they examined the children's initiation attempts, use of scripted language, adaptation of language to context, and nonverbal communication. They, too, found no negative associations between bilingualism and language development for either simultaneous or sequential bilinguals. As the only published study on bilingualism and autism in a non-Western context, the authors argued that the findings are not likely due to earlier

diagnosis, early access to treatment, or the enhanced health and educational services available in other parts of the world.

Taken together, these studies refute a common assumption that exposure to more than one language causes confusion and/or exacerbates communication difficulties for individuals on the autism spectrum. The findings converge to show bilingual and monolingual children on the autism spectrum performing similarly across a variety of developmental domains. There is even evidence to suggest that bilinguals outperform monolinguals in certain areas, such as expressive vocabulary and prelinguistic vocalizations and gestures. These findings mirror those from studies of bilingual children with other disabilities, such as specific language impairment (Gutierrez-Clellen, Simon-Cereijido, & Wagner, 2008; Håkansson & Nettelbladt, 1996; Paradis, Crago, & Rice, 2003; Thordardottir, Ellis Weismer, & Smith, 1997) and Down syndrome (Cleave, Kay-Raining Bird, Trudeau, & Sutton, 2014; Kay-Raining Bird et al., 2005).They show that children of diverse abilities and developmental trajectories are capable of and benefit from learning more than one language.

The current findings echo what has long been acknowledged for children without disabilities—that bilingualism is not a hindrance but rather represents an asset in many respects for the developing child. The ability to speak another language is in itself a benefit. Many additional advantages exist beyond the functional ability to communicate in more than one language. For children of immigrant parents, for example, proficiency in the family language offers a means of bonding and intimacy and access to extended familial and community social networks and facilitates a sense of cultural identity and belonging (Fishman, 2006; Golash-Boza, 2005; Kondo-Brown, 2006; Lao, 2004). Some researchers have also observed cognitive advantages in bilingual children. Goetz (2003) found that 3- and 4-year-old bilinguals outperformed monolinguals in specific theory-of-mind tasks. Similarly, Bialystok, Craik, and Luk (2012) found that bilinguals were better at certain metacognitive and metalinguistic tasks involving attentional inhibition and control. In the light of these findings, there is a convergence of opinion among bilingual researchers that professionals should support families in maintaining heritage languages use with their children, whether they are typically or differently developing (Artiles & Ortiz, 2002; Gutierrez-Clellen, 1999; Kohnert, 2010; National Research Council, 2001; Tabors, 2008). The implications of these findings may be particularly significant for children on the autism spectrum given the importance of social connectedness and cognitive flexibility in addressing the core challenges of autism.

Role of Home Languages in English Acquisition

Some parents of children on the autism spectrum give up speaking their home languages with their children not because they believe their children are incapable of bilingualism but because they wish to accelerate their children's English acquisition (Yu, 2013). This is because many valuable educational and intervention programs are available only in English (Yu, 2013, 2016a). Promoting English proficiency is therefore a high priority for families, yet few parents have access to accurate information about how to support their children's acquisition of English as a second language (King & Fogle, 2006; Sakamoto, 2006; Yu, 2013).

Many parents believe, and are told by professionals, that speaking only English is the most effective and fastest way to help their children learn the language (Yu, 2013). This is a myth. Although learning a new language requires consistent exposure to the language, it is not helpful for that exposure to come at the cost of the child's primary language. A strong foundation in a first language, particularly when it is the primary language of family members and their social networks, supports the learning of a second language (Center for Applied Linguistics, 2005; Wei & Zhou, 2003; Wong-Fillmore, 2009). For example, Seung, Siddiqi, and Elder (2006) found that a Korean-speaking preschooler on the autism spectrum benefited from speech-language therapy in his primary language, which helped him make steady progress toward his therapy goals over time and also supported his learning of English. Similarly, Perozzi and Chavez-Sanchez (1992) found that Spanish-speaking first graders with language delays acquired new English vocabulary twice

as quickly when those words were first explained to them in Spanish compared with when they were taught only in English. In a case study of a child with language impairment, Thordardottir et al. (1997) also found that the child acquired more English vocabulary in response to a bilingual approach over a monolingual one. All of these studies point to the positive contributions of family languages as a mediating factor in the learning of additional languages.

There is also evidence that stopping the use of the primary language causes significant disruptions to the children's participation within family routines (Yu, 2016a), parent–child relationships (Kremer-Sadlik, 2004), and parents' sense of self-efficacy for supporting their children's learning and development (Wharton, Levine, Miller, Breslau, & Greenspan, 2000). These disruptions undercut the important roles that parents play in their children's education and academic success, which includes English acquisition. Wong-Fillmore (2009) emphasized the importance of everyday routines as a basis for the development of academic language and literacy. She argued that proficiency in academic language goes beyond the mastery of English; rather, it involves a way of thinking about, structuring, and deciphering language that is not native to speakers of any language but always requires explicit instruction. Parents play an indispensable role in providing these experiences of academic thinking and literacy practices regardless of what languages they use in achieving these means (Quiroz & Dixon, 2012).

Considering the importance of maintaining continuity across learning contexts for children on the autism spectrum, it is critical that practitioners understand the roles of primary language use in bridging the potential gaps between home and school learning. The need for consistency is often cited as a reason for speaking only one language with children on the autism spectrum, but it is problematic to assume that speaking only English is the best way to offer consistency. What is more important than offering the same language across settings is providing environments that are consistently rich in meaning and contextual relevance. Although English proficiency is important for success in school and the wider U.S. society, learning English does not have to come at the expense of home language development. When children suddenly lose access to the languages that are familiar and meaningful to them and are thrust into an entirely new language environment, they can feel frightened and disoriented. It also deprives them of the foundations upon which to build additional language competencies.

Guidelines for AAC Practitioners

Bilingual AAC supports can offer many benefits for children on the autism spectrum growing up in environments where more than one language is spoken. AAC practitioners have the responsibility to provide culturally and linguistically responsive services that meet the communication needs of the child across the school, home, and community. With effective collaboration between family members and professionals, AAC systems can play an important role in supporting bilingual development, maintaining home language, and learning English as a second language. Currently, there are no studies targeting bilingual AAC use with children on the autism spectrum, and more research is needed in this area. Building on my experience as a researcher and clinician, I offer three guidelines for serving bilingual families of children on the autism spectrum who use AAC.

First, it is important to know that language use preferences within families are complex, changing, and deeply personal. Parents are often given advice about what languages they should use with their children with autism, but what parents really need is to be understood and informed in order to arrive at their own decisions. Respect parents' language choices for their children. Rather than dispensing advice, professionals can play an important role in assuaging parents' fears and misapprehensions about bilingualism and second language learning as they explore their choices.

Second, professionals should partner with parents to develop AAC systems that include culturally relevant symbols and messages that facilitate participation in locally meaningful

activities. This may necessitate systems that have the ability to convey more than one language. For example, a picture symbol for water can be labeled with both the Spanish word *agua* and the English word *water* to allow the child to express a concept in two different ways. Bilingual representation can also help bridge the gap between the language of the school and of the home as the child travels across settings. Robillard, Mayer-Crittenden, Minor-Corriveau, and Bélanger (2014) found significant similarities and overlaps between the core vocabularies for monolingual and bilingual children with and without language disabilities. Also, Boenisch and Soto (2015) found significant overlap in core vocabulary in English for school-aged native speakers and those who were learning English as a second language. Some concepts across languages do not translate directly, however, so it is important to offer children the ability to express unique vocabulary and phrases that are relevant across language environments.

Finally, it is important to develop flexible systems that allow the child to switch quickly and easily between languages. Bilinguality is not simply the storage of two interchangeable language systems in one head. Language use and language learning are embodied, culturally situated experiences that are distributed differentially (Urciuoli, 1985). Rarely do languages in a bilingual individual's repertoire overlap completely in their routine usage and sociocultural functions. One language might be more relevant within certain settings/activities, with particular partners, or with regard to certain topics. For example, an individual might be proficient in using Italian to speak with his or her family about domestic affairs but feeling at a loss for words when asked to communicate in a formal or professional setting in the language.

An important skill in the life of a bilingual is to fluidly adapt their language use to the situations at hand, whether that involves selecting a particular language, code-switching between languages, or using a hybridized variety influenced by both languages (Heller, 2007; Yu, 2016a, 2016b). Bilingual children learn from other bilinguals in their communities how to navigate and adapt to the different linguistic demands in their social environments (Zentella, 1997). Bilingual AAC systems need to have the capacity for these creative communicative practices that are unique to bilingual life.

Conclusion

In today's global society, bilingualism/multilingualism has been increasingly regarded as an asset; however, the rhetoric about bilingualism/multilingualism with regard to children on the autism spectrum has remained strongly deficit-oriented. Many professionals and parents alike assume that bilingualism would be detrimental to children with disabilities, especially those with complex communication needs. As a result, many families give up on speaking their home languages with their children, which can disrupt the socialization, participation, and acculturation processes in the home. The purpose of this article was to offer practitioners current, evidence-based information about bilingualism and autism to share with their clients and colleagues and guidelines for providing bilingual AAC services. AAC professionals can play an important role in dispelling misunderstandings about bilingualism and helping parents make informed language use decisions that support and strengthen their families' communication goals and that build on their children's competencies.

References

American Speech-Language-Hearing Association. (2004). *Knowledge and skills needed by speech-language pathologists and audiologists to provide culturally and linguistically appropriate services* [Knowledge and Skills]. Retrieved from http://www.asha.org/policy

Artiles, A., & Ortiz, A. A. (Eds.). (2002). *English language learners with special education needs: Identification, assessment, and instruction*. McHenry, IL: Delta Systems.

Bayley, N. (2006). *Bayley Scales of Infant and Toddler Development–Third Edition*. San Antonio, TX: Harcourt Assessment, Inc.

Bialystok, E., Craik, F. I. M., & Luk, G. (2012). Bilingualism: Consequences for mind and brain. *Trends in Cognitive Sciences, 16*(4), 240–250.

Boenisch, J., & Soto, G. (2015). The oral core vocabulary of typically developing English-speaking school-aged children: Implications for AAC practice. *Augmentative and Alternative Communication, 31*(1), 77–84.

Center for Applied Linguistics. (2005). *Parenting for academic success: A curriculum for families learning English research base*. Washington, DC: Center for Applied Linguistics.

Cleave, P. L., Kay-Raining Bird, E., Trudeau, N., & Sutton, A. (2014). Syntactic bootstrapping in children with Down syndrome: The impact of bilingualism. *Journal of Communication Disorders, 49,* 42–54.

Crystal, D. (2018). *The language revolution*. Hoboken, NJ: Wiley.

Drysdale, H., van der Meer, L., & Kagohara, D. (2015). Children with autism spectrum disorder from bilingual families: A systematic review. *Review Journal of Autism and Developmental Disorders, 2*(1), 26–38.

Fishman, J. A. (2006). What is reversing language shift (RLS) and how can it succeed? In N. H. Hornberger & M. Pütz (Eds.), *Language loyalty, language planning and language revitalization: Recent writings and reflections from Joshua A. Fishman* (pp. 79–112). Clevedon, England: Multilingual Matters.

Goetz, P. J. (2003). The effects of bilingualism on theory of mind development. *Bilingualism: Language and Cognition, 6*(1), 1–15.

Golash-Boza, T. (2005). Assessing the advantages of bilingualism for the children of immigrants. *International Migration Review, 39*(3), 721–753. https://doi.org/10.1111/j.1747-7379.2005.tb00286.x

Gutierrez-Clellen, V. F. (1999). Language choice in intervention with bilingual children. *American Journal of Speech-Language Pathology, 8*(4), 291–303.

Gutierrez-Clellen, V. F., Simon-Cereijido, G., & Wagner, C. (2008). Bilingual children with language impairment: A comparison with monolinguals and second langauge learners. *Applied Psycholinguistics, 29*(1), 3–19.

Håkansson, G., & Nettelbladt, U. (1996). Similarities between SLI and L2 children: Evidence from the acquisition of Swedish word order. In C. E. Johnson & J. H. Gilbert (Eds.), *Children's language*. Hillsdale, NJ: Erlbaum.

Hambly, C., & Fombonne, E. (2012). The impact of bilingual environments on language development in children with autism spectrum disorders. *Journal of Autism and Developmental Disorders*, *42*(7), 1342–1352. https://doi.org/10.1007/s10803-011-1365-z

Heller, M. (Ed.). (2007). *Bilingualism: A social approach*. Basingstoke, England: Macmillan.

Kay-Raining Bird, E., Cleave, P. L., Trudeau, N., Thordardottir, E., Sutton, A., & Thorpe, A. (2005). The language abilities of bilingual children with Down syndrome. *American Journal of Speech-Langugage Pathology, 14,* 187–199. https://doi.org/10.1044/1058-0360(2005/019)

King, K. A., & Fogle, L. (2006). Bilingual parenting as good parenting: Parents' perspectives on family language policy for additive bilingualism. *The International Journal of Bilingual Education and Bilingualism, 9*(6), 695–712. https://doi.org/10.2167/beb362.0

Kohnert, K. (2010). Bilingual children with primary language impairment: Issues, evidence and implications for clinical actions. *Journal of Communication Disorders*, *43*(6), 456–473.

Kondo-Brown, K. (Ed.). (2006). *Heritage language development: Focus on East Asian immigrants*. Amsterdam, the Netherlands: John Benjamins.

Kremer-Sadlik, T. (2004). *To be or not to be bilingual: Autistic children from multilingual families*. Paper presented at the Fourth International Symposium on Bilingualism, Tempe, AZ.

Lao, C. (2004). Parents' attitudes toward Chinese–English bilingual education and Chinese-language use. *Bilingual Research Journal*, *28*(1), 99–121. https://doi.org/10.1080/15235882.2004.10162614

National Research Council. (2001). *Educating children with autism*. Washington, DC: National Academies Press.

Ohashi, J. K., Mirenda, P., Marinova-Todd, S., Hambly, C., Fombonne, E., Szatmari, P., . . . Thompson, A. (2012). Comparing early language development in monolingual- and bilingual-explosed young children with autism spectrum disorders. *Research in Autism Spectrum Disorders, 6,* 890–897.

Paradis, J., Crago, M., & Rice, M. (2003). French–English bilingual children with SLI: How do they compare with their monolingual peers? *Journal of Speech, Language, and Hearing Research, 46,* 113–127. https://doi.org/10.1044/1092-4388(2003/009)

Perozzi, J. A., & Chavez-Sanchez, M. L. (1992). The effect of instruction in L1 on receptive acquisition of L2 for bilingual children with language delay. *Language, Speech, and Hearing Services in Schools, 23,* 348–382.

Petersen, J. M., Marinova-Todd, S., & Mirenda, P. (2012). Brief report: An exploratory study of lexical skills in bilingual children with autism spectrum disorder. *Journal of Autism and Developmental Disorders, 42*(7), 1499–1503. https://doi.org/10.1007/s10803-011-1366-y

Quiroz, B., & Dixon, L. (2012). Mother–child interactions during shared literacy activities: Education in a fractured bilingual environment. *Journal of Early Childhood Literacy, 12*(2), 139–175.

Reetzke, R., Zou, X., Sheng, L., & Katsos, N. (2015). Communicative development in bilingually exposed Chinese children with autism spectrum disorders. *Journal of Speech, Language, and Hearing Research, 58*(1), 813–825. https://doi.org/10.1044/2015_JSLHR-L-13-0258

Robillard, M., Mayer-Crittenden, C., Minor-Corriveau, M., & Bélanger, R. (2014). Monolingual and bilingual children with and without primary language impairment: Core vocabulary comparison. *AAC: Augmentative and Alternative Communication, 30*(3), 267–278. https://doi.org/10.3109/07434618.2014.921240

Rossetti, L. (1990). *Rossetti Infant–Toddler Language Scale*. East Moline, IL: LinguiSystems.

Sakamoto, M. (2006). Balancing L1 maintenance and L2 learning: Experiential narratives of Japanese immigrant families in Canada. In K. Kondo-Brown (Ed.), *Heritage language development: Focus on East Asian Languages* (pp. 33–56). Amsterdam, the Netherlands: John Benjamins.

Schopler, E., Van Bourgondien, M. E., Wellman, G. J., & Love, S. R. (2010). *Childhood Autism Rating Scale*. Los Angeles, CA: Western Psychological Services.

Seung, H., Siddiqi, S., & Elder, J. H. (2006). Intervention outcomes of a bilingual child with autism. *Journal of Medical Speech-Language Pathology, 14*(1), 53–63.

Sparrow, S. S., Cicchetti, D. V., & Balla, D. A. (2005). *Vineland Adaptive Behavior Scales–Second Edition*. Circle Pines, MN: AGS.

Tabors, P. O. (2008). *One child, two languages: A guide for early childhood educators of children learning English as a second language* (2nd ed.). Baltimore, MD: Brookes.

Thordardottir, E., Ellis Weismer, S., & Smith, M. (1997). Vocabulary learning in bilingual and monolingual clinical intervention. *Child Language Teaching and Therapy, 13*(3), 215–227. https://doi.org/10.1177/026565909701300301

Urciuoli, B. (1985). Bilingualism as code and bilingualism as practice. *Anthropological Linguistics, 27*(4), 363–386.

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

Wei, Y., & Zhou, Y. (2003). *Language minority parents' involvement in their child's English education: A case study of a young ELL student*. Paper presented at the Annual Meeting of Teachers of English to Speakers of Other Languages, Baltimore, MD.

Wharton, R. H., Levine, K., Miller, E., Breslau, J., & Greenspan, S. I. (2000). Children with special needs in bilingual families: A developmental approach to language recommendations. In S. I. Greenspan & S. Wieder (Eds.), *The Interdisciplinary council on developmental and learning disorders clinical practice guidelines* (pp. 141–151). Bethesda, MD: ICDL.

Wong-Fillmore, L. (2009). *Academic English: A story of glitches and gaps in learning the language of learning*. Paper presented at the talk sponsored by the Language, Literacy, Society and Culture Area in the Graduate School of Education, University of California, Berkeley.

Yu, B. (2013). Issues in bilingualism and heritage language maintenance: Perspectives of minority-language mothers of children with autism spectrum disorders. *American Journal of Speech-Language Pathology, 22*(1), 10–24. https://doi.org/10.1044/1058-0360(2012/10-0078)

Yu, B. (2016a). Bilingualism as conceptualized and bilingualism as lived: A critical examination of the monolingual socialization of a child with autism in a bilingual family. *Journal of Autism and Developmental Disorders, 46*(2), 424–435. https://doi.org/10.1007/s10803-015-2625-0

Yu, B. (2016b). Code-switching as a communicative resource within routine, bilingual family interactions for a child on the autism spectrum. *Perspectives of the ASHA Special Interest Groups, 1*(14), 17–28.

Zentella, A. C. (1997). *Growing up bilingual*. Malden, MA: Blackwell.

Zimmerman, I. L., Steiner, V. G., & Pond, R. E. (2002). *Preschool Language Scale–Fourth Edition*. San Antonio, TX: The Psychological Corporation.

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