Enhancing Language Development in Children with Autism: A Comprehensive Guide to Phonological Assessment and Intervention

Eman Subhi Alhaj-Mousa

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Contents

Chapter 2:

Phonological Measures in Language Development

2.0 Introduction

In this chapter, we delve into the existing body of research that has employed phonological measurements to track language development in both typically developing (TD) children and those with various language challenges. Phonological measures, such as the phonological mean length of utterance (pMLU), have been pivotal in evaluating language abilities and identifying potential language impairments, particularly in children with Autism Spectrum Disorder (ASD). This chapter highlights how these measurements have been used across different linguistic and cultural backgrounds, focusing on children with ASD and language impairments in various languages. The chapter aims to provide a comprehensive overview of how these tools have contributed to our understanding of language development and the identification of language disorders.

2.1 Language Measures for Typically Developing (TD) Children

Research into the language development of typically developing (TD) children has provided crucial benchmarks against which language impairments can be measured. One such study by Al-Sulaihim and Marinis (2017) investigated the development of phonological awareness in Kuwaiti-Arabic-speaking school-age children. Their primary goal was to assess whether the phonological awareness abilities in Arabic-speaking children were comparable to those observed in other languages, such as English. They also explored the correlation between phonological awareness and reading skills. The study involved evaluating a beginner reading group to assess their letter knowledge and single-word reading skills. The findings indicated that literacy training significantly enhanced both phonological awareness and reading skills in these children. Notably,

after literacy training, the children demonstrated substantial progress in phoneme awareness, especially in the identification and deletion of phonemes （Al-Sulaihim & Marinis, 2017）.

Phonological measures like pMLU have also been utilized to compare the language development of bilingual children with their monolingual peers. Bunta et al. (2009) explored the use of phonological whole-word measures (pMLU, PWP, PCC) in bilingual Spanish- and English-speaking 3-year-old children and their monolingual age-matched peers. Their study concluded that while bilingual children showed differentiation in their target languages in terms of phonological whole-word complexity and consonant accuracy, there was a consistent effort to maintain proximity to the phonological target. This suggests that maintaining a constant level of phonological proximity to the target is a key driving force in phonological acquisition （Bunta et al., 2009）.

In another study, Karimian et al. (2022) used story generation and conversation sampling methods to compare pMLU and PWP in Persian-speaking children with Isfahani accents, aged 48 to 60 months. The study also examined the sensitivity of pMLU to growth over time. The findings revealed significant differences in target pMLU between the two sampling methods, although PWP did not differ significantly. The study's inter-rater reliability was 0.70, indicating a moderate level of agreement between raters. These results provide a foundation for future quantitative studies in children's phonological assessment using Persian whole words and suggest the potential for pMLU as a sensitive measure of phonological development in different linguistic contexts （Karimian et al., 2022）.

Beers, Rodenburg, and Gerrits (2019) conducted a phonological study on Dutch children to determine if an increase in pMLU scores with age would reflect the acquisition of the Dutch phonological repertoire. Their results indicated that higher pMLU scores in younger children could be attributed to their more advanced vocabulary, leading to no significant difference between larger and smaller word samples. However, the small phonological inventory and longer target words in Dutch may have resulted in mispronunciations of longer words, leading to lower pMLU scores. The study's selection criteria may have also caused a ceiling effect, with pMLU scores of children between 1;3 and 1;8 representing the highest level attainable at that age （Beers, Rodenburg, & Gerrits, 2019）.

2.2 Phonological Measures for Children with Different Language Disorders/Impairments

Phonological measures, particularly pMLU, have been instrumental in identifying and tracking language delays or disorders in children. Studies by Kumar and Bhat (2009) and Schauwers et al. (2005) focused on determining pMLU scores in children with language disorders compared to their typically developing peers. These studies emphasized the importance of assessing speech and language development in children with disorders, noting that children detected and treated earlier exhibited more proficiency than those diagnosed later. Both studies reported lower pMLU scores in children with language disorders than in age-matched typically developing peers, highlighting the utility of pMLU as a benchmark for phonological development and a developmental scale for comparing disordered phonology. The findings suggest that pMLU could be a valuable tool for tracking language development in children at risk of developmental delays or disorders （Kumar & Bhat, 2009; Schauwers et al., 2005）.

In a study on Finnish-speaking children with specific language impairment (SLI) and dyspraxic speech features, Kunnari, Helin, and Makonen (2012) aimed to understand how these phonological errors were reflected in pMLU results. They compared pMLU, PWP, and PWC values in SLI children to those of age-matched typically developing children. The study revealed that SLI children had lower levels of language development, particularly in terms of pMLU, PWP, and PWC values, and their language development was more similar to that of typically developing 2-year-olds than children of the same age. This research underscores the importance of qualitative analysis in understanding the phonological characteristics of language disorders（Kunnari, Helin, & Makonen, 2012）.

Newbold, Stackhouse, and Wells (2013) analyzed the developmental speech difficulties of children with severe and persistent speech difficulties (SPSD). Their study aimed to monitor the progress of these children over time using speech output measures such as PWP, PWC, and PCC. The results indicated that while PWC can detect change if the same stimuli are used consistently, PCC is a more reliable measure of change due to its lesser sensitivity to the choice of stimuli. PWP, though useful for measuring speech outcomes across tasks and over time, is more sensitive to psycholinguistic variables than PCC. The study highlights the potential of PCC and PWP in evaluating speech outcomes in children with severe speech difficulties（Newbold, Stackhouse, & Wells, 2013）.

Burrows and Goldstein (2010) conducted a study involving Spanish–English bilinguals with speech sound disorders (SSD) and their age-matched monolingual peers. They used phonological measures such as pMLU, PWP, and PCC to compare the two groups. The study found that while both monolinguals and bilinguals with SSD aimed to produce words similar to the adult target,

monolinguals had higher PCC, pMLU, and PWP scores, indicating that their productions were more accurate, complex, and closer to the target. This study highlights the potential of phonological measures in differentiating between bilingual and monolingual children with speech disorders（Burrows & Goldstein, 2010）.

Another study by Helin (2011) focused on Finnish-speaking children, including those with specific language impairment (SLI) and typically developing children. The primary objective was to assess the appropriateness of the pMLU method in analyzing language acquisition. The study found that pMLU values for Finnish-speaking children were notably high towards the end of the one-word stage, and their phonological development during the follow-up period was reflected in pMLU, PWP, and PWC values. While the study had limitations in detecting qualitative differences between the children, it identified typological features that cause cross-linguistic differences in pMLU values, emphasizing the importance of considering linguistic diversity in phonological research（Helin, 2011）.

2.3 ASD Children with Language Delay/Disorders/Impairment

Autism Spectrum Disorder (ASD) is a lifelong neurodevelopmental condition that significantly impacts communication and social interaction. Research into ASD has revealed a much higher prevalence of the condition than previously thought, particularly in recent decades. Studies by Fombonne (2003, 2005, 2011) have shown that ASD affects a larger portion of the population than earlier estimates suggested. Baio (2018) and the Centers for Disease Control (2012) utilized The Autism and Developmental Disabilities Monitoring (ADDM) Network Program to collect data on the prevalence and characteristics of children with ASD in the United States. Their research found a significant increase in the number of children diagnosed with ASD over recent years,

highlighting the growing need for effective diagnostic and intervention strategies （Fombonne, 2003, 2005, 2011; Baio, 2018; Centers for Disease Control, 2012）.

ASD and Specific Language Impairment (SLI) have traditionally been considered distinct conditions with separate etiologies. However, some studies have explored the possibility of shared genetic factors contributing to both disorders. Bishop (2010) examined the potential for nonadditive genetic influences that might explain familial and molecular findings in ASD and SLI. Using a modified simulation incorporating gene-gene (G × G) interactions, the study found levels of comorbidity and impairment rates in relatives that align more closely with observed data. The results support a model suggesting a shared genetic basis for ASD and SLI, consistent with molecular genetic findings on CNTNAP2. This research provides new insights into the complex genetic interactions that may contribute to both ASD and SLI （Bishop, 2010; Lindgren et al., 2009）.

The early language development of infants who later develop ASD has also been a focus of research. Lazenby et al. (2016) conducted a prospective data analysis on a cohort of infants, including those at high risk for ASD. The study aimed to investigate whether language differences could be detected at 12 months in infants who were later diagnosed with ASD. The findings revealed significant language differences in high-risk infants, with notable quantitative differences on two measures at 12 months. Interestingly, despite their lower overall language ability, the high-risk ASD group showed a higher likelihood of producing and understanding certain words in a statistically unexpected manner, suggesting unique patterns of early language development in infants at risk for ASD （Lazenby et al., 2016）.

Miller et al. (2015) evaluated early pragmatic language skills in preschool-age siblings of children with ASD, examining the correspondence between pragmatic language impairments and general language difficulties, autism symptomatology, and clinical outcomes. The study found that siblings at high risk for ASD had lower parent-rated pragmatic language scores compared to a low-risk group, with a significant proportion of the high-risk group exhibiting pragmatic language impairment (PLI). Children with PLI also showed higher rates of general language impairment and more atypical clinical outcomes, indicating that early pragmatic language difficulties may be a marker of broader language and developmental challenges in siblings of children with ASD （Miller et al., 2015）.

Phonological development is a crucial aspect of language acquisition, and children with ASD often exhibit unique challenges in this area. Studies by Paul et al. (2011) and Lombardino and Lerman (2005) examined the phonological features of speech in verbal children with ASD compared to typically developing children. These studies found that children with ASD face significant challenges in phonological development, particularly in mastering speech sounds and sound patterns. These difficulties can manifest as sound repetitions, substitutions, and other atypical speech characteristics, which may contribute to the broader communication difficulties experienced by children with ASD （Paul et al., 2011; Lombardino & Lerman, 2005）.

Research by Tager, Rogers, and Cooper (2005) found that children with ASD had delays in acquiring phonological skills compared to typically developing children. These delays may contribute to the language difficulties observed in children with ASD, as phonological skills are foundational to effective communication. Similarly, Vogan et al. (2014) investigated phonological working memory abilities in children with ASD, finding that they had lower abilities in this area

compared to typically developing children. These deficits in phonological working memory may further exacerbate the language and communication challenges faced by children with ASD（Tager, Rogers, & Cooper, 2005; Vogan et al., 2014）.

Recently, a study by Alqhazo, Hatamleh, and Bashtawi (2020) examined the phonological and lexical abilities of Arabic-speaking children with ASD. The Jeddah Institute for Speech and Hearing (JISH) Test was used to assess the children's phonological abilities, while the JISH School Readiness Screening Test measured their lexical abilities. The study found that children with ASD exhibited both phonological and lexical impairments, with phonological impairment being more prevalent. These findings have important implications for speech-language pathologists in developing tailored treatment plans that address both phonological and lexical deficits in children with ASD（Alqhazo, Hatamleh, & Bashtawi, 2020）.

Research by Ha and Pi (2022) compared phonological processing skills and development in children with phonological delay, disorder, and ASD to those of typically developing children. The study found that children with phonological disorders scored lower in phonological awareness and non-word repetition compared to their typically developing peers. The ASD group showed a delayed pattern of phonological acquisition similar to that found in children with intellectual disabilities. Additionally, children with phonological delay or disorder performed poorly on rapid automatized naming tasks compared to typically developing children, further highlighting the phonological challenges faced by children with ASD（Ha & Pi, 2022; Bartolucci & Pierce, 1977）.

2.4 Phonological Measures for Children with ASD

Phonological measures have proven to be effective tools in assessing language development and guiding interventions for children with ASD. Sendhilnathan and Chengappa (2020) investigated the effects of language intervention on vocabulary development in monolingual and bilingual children with ASD in Singapore. The study found that exposure to multiple languages did not negatively impact language development in children with ASD. Instead, both monolingual and bilingual groups showed significant increases in vocabulary growth following 24 weeks of language intervention. The study emphasizes the importance of using developmentally appropriate language-building strategies to facilitate successful communication across pragmatic contexts in children with ASD（Sendhilnathan & Chengappa, 2020）.

Shillingsburg et al. (2019) focused on increasing the complexity of mand utterances in children with ASD. Using a treatment package that included errorless teaching, differential reinforcement, and systematic decision rules, the study aimed to increase the number of words per mand utterance. The results showed significant developmental gains in the participants' mean length of utterances, accompanied by increased rates of manding and a corresponding decrease in non-verbal indicating responses. This study highlights the potential for targeted interventions to improve verbal communication in children with ASD（Shillingsburg et al., 2019）.

Yeganeh and Kamari (2020) explored the developmental process of Mean Length of Utterance (MLU) in children with ASD compared to typically developing children. The study found a clear delay in MLU development in children with ASD, indicating weaker syntactic development compared to the control group. This research underscores the importance of MLU as a measure of linguistic development and its potential to highlight the syntactic challenges faced by children with ASD（Yeganeh & Kamari, 2020）.

Herrera and Almeida (2008) studied the phonological mean length of utterance (pMLU) in individuals with high-functioning autism (HFA) and Asperger Syndrome (AS). The study aimed to increase MLU in these individuals using verbal communicative skill strategies. The results showed a significant increase in MLU for all participants, suggesting that targeted interventions can effectively improve verbal communication in individuals with HFA and AS. The study also recommends further research to examine the maintenance of these improvements in different environments and contexts（Herrera & Almeida, 2008）.

A meta-analysis by Sandbank and Yoder (2016) investigated the correlation between parental mean length of utterance (MLU) and language outcomes in children with disabilities, including ASD. The analysis found a weak positive association between parental input length and child language outcomes across all studies. However, in children with autism, the correlation was stronger, suggesting that the length of parental utterances may have a more significant impact on language development in this population. This finding underscores the importance of parental input in shaping language outcomes for children with ASD（Sandbank & Yoder, 2016）.

2.5 Conclusion

The majority of previous studies in this field have explored language development and difficulties in children with ASD, with some using the phonological mean length of utterance (pMLU) as a key measure. pMLU has been employed to assess language development in various contexts, from typically developing children to those with language disorders, including ASD. These studies highlight the utility of pMLU and other phonological measures in tracking language development, identifying language impairments, and guiding interventions. While much progress has been made

in understanding language development in children with ASD, further research is needed, particularly in underrepresented linguistic groups such as Arabic-speaking children with ASD.

References

Alqhazo, M. T., Hatamleh, L. S., & Bashtawi, M. (2020). Phonological and lexical abilities of Jordanian children with autism. Applied neuropsychology. Child, 9(2), 116–124.

Al-Sulaihim, N., & Marinis, T. (2017). Literacy and Phonological Awareness in Arabic Speaking Children. Arab Journal of Applied Linguistics, 2(1), 74–90.

Amayreh, M. M., & Dyson, A. T. (1998). The acquisition of Arabic consonants. Journal of Speech, Language, and Hearing Research, 41(3), 642-653.

American Psychiatric Association. (2013). Diagnostic and statistical manual of mental disorders (5th ed.). https://doi.org/10.1176/appi.books.9780890425596

Asperger, H. (1944). Die "autistischen Psychopathen" im Kindesalter, Archiv fur Psychiatrie und Nervenkrankheiten, 117, 76–136 [Autistic psychopathy in childhood] (U. Frith (Ed.), Trans., (1991), Autism and Asperger syndrome (pp. 37–92)). Cambridge, England: Cambridge University Press.

Babatsouli, E., Ingram, D.E., & Sotiropoulos, D.A. (2014). Phonological Word Proximity in Child Speech Development.

Baio, J. (2018). Prevalence of Autism Spectrum Disorder Among Children Aged 8 Years — Autism and Developmental Disabilities Monitoring Network, 11 Sites, United States, 2014. MMWR Surveillance Summaries, 67(6), 1–23.

Baron-Cohen, S., Leslie, A. M., & Frith, U. (1985). Does the autistic child have a "theory of mind"? Cognition, 21(1), 37–46.

Baron-Cohen, S., Leslie, A. M., & Frith, U. (1985). Does the autistic child have a "theory of mind"? Cognition, 21(1), 37–46. https://doi.org/10.1016/0010-0277(85)90022-8

Bartolucci, G., & Pierce, S. J. (1977). A preliminary comparison of phonological development in autistic, normal, and mentally retarded subjects. British Journal of

Disorders of Communication, 12(2), 137–147.

Beers, M., Rodenburg-Van Wee, M., & Gerrits, E. (2019). Whole-word measures and the speech production of typically developing Dutch children. Clinical Linguistics & Phonetics,1–16. doi:10.1080/02699206.2019.1596163.

78

Bernard Rimland, Infantile Autism: The Syndrome and Its Implications for a Neural Theory of Behavior (New York: Appleton-Century-Crofts, 1964).

Bettelheim, B. 1950. Love Is Not Enough. New York, The Free Press.

Bishop, D. V. (2010). Overlaps between autism and language impairment: phenomimicry or shared etiology?. Behavior genetics, 40, 618-629.

Brown, R. (1973). A first language: The early stages. Cambridge, MA: Harvard University Press.

Bunta, F., Fabiano-Smith, L., Goldstein, B.A., & Ingram, D.E. (2009). Phonological whole-word measures in 3-year-old bilingual children and their age-matched monolingual peers. Clinical Linguistics & Phonetics, 23, 156 - 175.

Burrows, L., & Goldstein, B. A. (2010). Whole word measures in bilingual children with speech sound disorders. Clinical Linguistics & Phonetics, 24(4-5), 357–368. doi:10.3109/02699200903581067

Cohmer, Sean, "Infantile Autism: The Syndrome and Its Implications for a Neural Theory of Behavior (1964), by Bernard Rimland". Embryo Project Encyclopedia (2014-05-23). ISSN: 1940-5030 http://embryo.asu.edu/handle/10776/7896.

Folstein, S., & Rutter, M. (1977). Infantile autism: a genetic study of 21 twin pairs. Journal of child psychology and psychiatry, and allied disciplines, 18(4), 297–321.

https://doi.org/10.1111/j.1469-7610.1977.tb00443.x

Fombonne, E. (2003). Epidemiological surveys of autism and other pervasive developmental disorders: An update. Journal of Autism and Developmental Disorders, 33(4), 365-382.

Fombonne, E. (2005). Epidemiology of autistic disorder and other pervasive developmental disorders. Journal of Clinical Psychiatry, 66(Suppl 10), 3-8.

Fombonne, E., Quirke, S., & Hagen, A. (2011). Prevalence and characteristics of autism spectrum disorders in the ALSPAC cohort. Developmental Medicine and Child Neurology, 53(9), 704-708.

Ha, S., & Pi, M. (2022). Phonological Processing Skills of Children with Phonological Delay and Phonological Disorder. Communication Sciences & Disorders, 27(4), 844-854. doi: 10.12963/csd.22932

79

Helin, K., Makkonen, T & Kunnari, S. (2006). The Phonological mean length of utterance: the methodological challenge from cross-linguistic perspectives. Journal of Child Language, 33, 179-190.

Ingram, D. (2002). Phonological disability in children: Assessment and intervention. London: Whurr Publishers.

Ingram, K. D., & Ingram, D. (2001). A Whole-Word Approach to Phonological Analysis and Intervention. Language, Speech, and Hearing Services in Schools, 32(4), 271-283. doi:10.1044/0161-1461(2001/024)

Kanner, L. (1943). Autistic disturbances of affective contact. Nervous Child, 2, 217–250

Karimian F, Mohammadi R, Bemani Z, Kazemi Y, Kianfar F. Phonological Mean Length

of Utterance in 48-60-Month-old Persian-Speaking Children with Isfahani Accent: Comparison of Story Generation and Conversation Samples. jrehab 2022; 23 (3) :392-411

Kumar, R. and Bhat, Jayashree. S. (2009). Phonological Mean Length of Utterance (pMLU) in Kannada-Speaking Children. Language in India, 9, 489-502.

Kunnari, S., Saaristo-Helin, K., & Savinainen-Makkonen, T. (2012). Phonological mean length of utterance in specific language impairment: a multi-case study of children acquiring Finnish. Clinical linguistics & phonetics, 26(5), 428–444.

Lazenby, D. C., Sideridis, G. D., Huntington, N., Prante, M., Dale, P. S., Curtin, S., .. & Tager-Flusberg, H. (2016). Language differences at 12 months in infants who develop autism spectrum disorder. Journal of autism and developmental disorders, 46, 899-909.

Lombardino, L. J., & Lerman, D. C. (2005). Phonology and verbal behavior. In J. L. Matson (Ed.), Handbook of Assessment and Diagnosis of Autism Spectrum Disorder (pp. 99-122). New York, NY: Springer Science+Business Media.

Lopes-Herrera, S. A., & Almeida, M. A. (2008). The use of verbal communicative abilities to increase the mean length of utterance in high-functioning autism and Asperger Syndrome. Pró-Fono Revista de Atualização Científica, 20, 37-42.

Maggie M. Watson & Pamela Terrell (2012) Longitudinal changes in phonological wholeword measures in 2-year-olds, International Journal of Speech-Language Pathology,

14:4, 351-362

80

Miller, M., Young, G. S., Hutman, T., Johnson, S., Schwichtenberg, A. J., & Ozonoff, S. (2015). Early pragmatic language difficulties in siblings of children with autism:

Implications for DSM-5 social communication disorder?. Journal of Child

Psychology and Psychiatry, 56(7), 774-781

Newbold, E. J., Stackhouse, J., & Wells, B. (2013). Tracking change in children with severe

and persisting speech difficulties. Clinical linguistics & phonetics, 27(6-7), 521–539.

Paul, R., Shriberg, L. D., McSweeny, J. L., Cicchetti, D., Klin, A., & Volkmar, F. (2011).

Phonological analysis of speech in verbal children with autism spectrum disorder.

Journal of Autism and Developmental Disorders, 41(4), 408-422.

Pratt, C., Hopf, R., & Larriba-Quest, K. (2017). Characteristics of individuals with an autism

spectrum disorder (ASD). The Reporter, 21(17).

S. S. Aljameel, J. D. O'Shea, K. A. Crockett, A. Latham, & M. Kaleem. (2017).

Development of an Arabic Conversational Intelligent Tutoring System for Education

of children with ASD. In 2017 IEEE International Conference on Computational

Intelligence and Virtual Environments for Measurement Systems and Applications

(CIVEMSA) (pp. 24-29). Annecy, France. doi: 10.1109/CIVEMSA.2017.7995296.

Saaristo-Helin, K. (2011). Phonological mean length of utterance as an indicator of typical

and impaired phonological development in children acquiring Finnish. University of

Helsinki.

Sandbank, M., & Yoder, P. (2016). The association between parental mean length of

utterance and language outcomes in children with disabilities: A correlational metaanalysis. American Journal of Speech-Language Pathology, 25(2), 240-251.

Schauwers, R., Taelman, S., Gillis, R., & Govierts, M. (2005). The phonological

development in young hearing-impaired children with a cochlear implant. Retrieved

June 17, 2007

Sendhilnathan, S., & Chengappa, S. K. (2020). Effect of Language Intervention on Mean

Length of Utterance in Monolingual and Bilingual Children with Autism Spectrum

Disorders in a Multi-Ethnic-Lingual Context. Language in India, 20(2).

81

Shillingsburg, M. A., Frampton, S. E., Schenk, Y. A., Bartlett, B. L., Thompson, T. M., &

Hansen, B. (2020). Evaluation of a treatment package to increase mean length of

utterances for children with autism. Behavior Analysis in Practice, 13, 659-673.

Shriberg, L. D., Austin, D., Lewis, B. A., McSweeny, J. L. (1997). The Percentage of

Consonants Correct (PCC) Metric: Extensions and Reliability Data. Journal of

Speech, Language, and Hearing Research, 40, 708-722. doi: 10.1044/jslhr.4003.708

Shriberg, L., & Kwiatkowski, J. (1982). Phonological disorders III: a procedure for

assessing severity of involvement. The Journal of speech and hearing disorders, 47

3, 256-70.

Tager-Flusberg H. (1992). Autistic children's talk about psychological states: deficits in the

early acquisition of a theory of mind. Child development, 63(1), 161–172.

Tager-Flusberg, H., Rogers, S., & Cooper, J. (2005). "Issues in the phonological processing

of autism spectrum disorders." Topics in Language Disorders,25(1), 75-82.

Vogan, V. M., Morgan, B. R., Powell, T. L., Smith, M. L., Taylor, M. J., & Thorpe, L. U.

(2014). The neural correlates of phonological working memory in children with

autism spectrum disorder. Journal of neurodevelopmental disorders, 6(1), 39.

Yeganeh, M. T., & Kamari, E. (2020). Investigating mean length of utterance (MLU) in

monolingual Persian speaking children with autism spectrum disorder

(ASD). International Journal of Health Studies, 6(2).