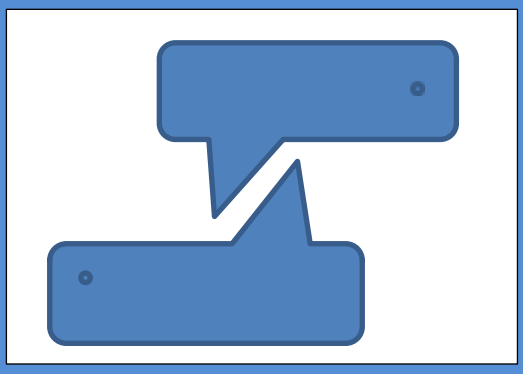
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Phonological awareness in biliterates of alphasyllabic and alphabetic orthography

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Abstract

Majority of the literature focused on the effect of L1 on the acquisition of L2 in most of the language aspects, but it is not possible to elude the influence of L2 on L1 processing especially young learners. As in the present study, learning Arabic along with Malayalam can be bewildering for children as Arabic has an alphabetic based orthography which is divergent from alpha syllabic Malayalam. Hence, this present study aimed to understand the phonological awareness in biliterates in comparison to monoliterates.

Forty participants were selected for the study. Among that, twenty participants were formally trained in both alpha syllabic (Malayalam) and alphabetic (Arabic) orthography were selected as a part of an academic curriculum with a minimum duration of three years. Another group of 20 children were trained only in Malayalam orthography (Alpha syllabic). Tasks included in the present study were phoneme isolation (initial and final), phoneme blending, phoneme deletion and phoneme segmentation.

Based on the descriptive and inferential statistics, it was evident that L2 orthography had no effect on L1 phonological awareness. Additionally, this study demonstrated that word composition complexity had no discernible impact on either the monoliterate (children who were trained only in alphasyllabic orthography) or biliterate (children who were trained in both alphasyllabic and alphabetic orthography) groups.

The present study shows that teaching entirely different languages from the native language cannot induce any adverse effect on the L1 orthography of the child. This information can be useful for the curriculum development for school-going children and be applicable to the assessment and treatment of bilingual children with reading difficulties.

Keywords: Biliterate, phonological awareness, alphasyllabic, alphabetic, orthogrpahy, Arabic, Malayalam

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1. Introduction

Phonological awareness (PA) is one of the key skills for the development of alphabetic orthography. This skill entails the perception of sub-lexical segments of speech at the level of phonemes, syllables, rimes, and onsets (Treiman, 1991). It can be represented by the capacity to mentally manipulate segments of speech such as tapping the syllables of a word, deleting onset of a word, or initial or final phoneme deletion of a word (McBride-Chang, 1995; Yopp, 1988). It also refers to one's "ability to recognize, discriminate, and manipulate the sounds in one's language, regardless of the size of the word unit that is the focus" (Antony & Francis, 2005). The development of PA abilities has been recognised as a crucial element of the development of literacy skills in both kindergarten and formal education. It is contingent on and mediated by the child's access to the phonology of his or her language (Wagner & Torgesen, 1987). In addition, it has often been studied within the context of children's literacy development. There is considerable evidence that phonemic awareness is closely related to successful learning to read and spell (Ball & Blachman, 1991). Initially, children develop a sensitivity to the larger phonological segments in speech and eventually adjust the sensitivity to discern smaller segments (Ziegler & Goswami, 2006). The capacity to create and recognize phonetic elements is innate in young children (Eimas et al.,, 1971).

Based on a single phoneme, very young children can identify words. However, they lack an innate talent that would enable them to purposefully modify phonological aspects along with this phonological aptitude (Durgunoglu & Öney, 1999). To comprehend and make use of the principles of the alphabetic system, researchers suggested that the development of both phonological awareness and letter knowledge is necessary (Byrne, 1998). However, according to a different perspective (Castles & Colheart, 2004), phonological awareness is a result of reading development rather than a prerequisite for reading.

Goswami (2010) lists variables that influence the emergence of PA prior to reading. The three factors namely, the syllabic construction of different languages, the vocabularies that make up those languages, and individual qualities such as perception all have an impact on how phonological awareness develops. Studies comparing the development of phonological awareness skills in opaque and transparent orthographic languages have found that children exposed to transparent orthography adopt phoneme-based reading strategies earlier than those exposed to opaque languages. In transparent languages like Spanish and Finnish, the majority of words can be pronounced out based on their spelling because of the great degree of uniformity in letter pronunciation. Many exceptions and abnormalities in pronunciation can be found in opaque languages like Portuguese and English, where words might have different pronunciations of the same letter combination.

An alphasyllabic writing system, or alphasyllabary, comes in between the alphabetic and syllabic types. In alpha syllabic writing systems, the basic grapheme represents a consonant, while an additional diacritic, or sometimes another transformation is applied, to denote the combination of

that particular consonant with a succeeding vowel (Castles & Colheart, 2004). Alphasyllabaries are a class of orthographies where sounds are indicated at the syllabic level and have special characteristics that denote sub syllabic/alphabetic information (Bright, 1996). Akshara knowledge is the best predictor of reading accuracy in alphasyllabaries. Alphabetical writing systems that use near-perfect phonemic writing have a unique letter for each individual phoneme, and a one-to-one resemblance between the sounds and the letters that indicate them.

According to studies in the Oriya language, syllable level awareness is more significant for word reading than phonemic awareness and does not play a significant role in learning to read Oriya (Mishra & Stainthorp, 2007; Padakannaya & Mohanty, 1995). Somashekara et al., (2014) found that PA skills are important for Malayalam speaking children at a young age, however the association between reading and PA is only valid for the first grade, not later grades.

Children can learn and develop syllable awareness skills more easily and earlier than phonemic awareness skills, which follow a similar course in Kannada (Tiwari et al., 2011). Furthermore, phonological knowledge was said to develop more gradually in Malayalam than in English.

A study by Alshaboul et al., (2014) investigated the relationship between English word reading and Arabic phonological awareness. One notable and unique result was the performance of English as L1 learners on the subtests of each of the three phonological awareness tests such as segmentation, matching and blending. An example given is, blending phoneme words as phonemes was the easiest followed by blending as syllables and onset-rimes. Moreover, the study revealed that children who learned well in Arabic phonological awareness were more prone to becoming better readers of English, an outcome that could change the teaching-learning development of English in the context of Arabic. Anthony and Francis (2005) suggest that children become more and more sensitive to smaller parts of words as they grow. This had no effect on native Arabic speakers, but proved clearer to English speakers.

Languages having entirely different phonological system may have varied metaphonological skills (Koda, 2005, 2008), and the quantity of information transfer between the phonological system also depends on their language similarity. Wang et al., 2006 had conducted a study in Korean–English biliterate and reported that orthographic information of Korea was not transferred to English, as there was vast disparity between the languages. Similarly, Chinese-English biliterate transferred phonological awareness skills, not orthographical information (Wang, Yang & Cheng, 2009).

This present study considered Malayalam-Arabic biliterate children as participants. Malayalam, a Dravidian language spoken in Kerala, India, uses a syllabic alpha letter system where each character denotes a syllable, not a sound. Arabic language is a semitic language native to Israel, Iran, Turkey, Middle Eastern countries, etc. An Arabic script is phonemic, that is, there is a high degree of regularity between the letters and characters of the language and their respective sounds. The Arabic language is written not only with the letters of the alphabet, but also with several characters not

viewed as part of the alphabet. In the discipline of teaching and studying Arabic as a second language, pronunciation has not received as much attention as other aspects such as morphology, syntax, sociolinguistics, and psycholinguistics. It has been stated in the fields of phonetics and phonology that Arabic pharyngealized sounds are distinctive and particular to Arabic, and they are seen to be the most challenging sounds for L2 learners of Arabic to acquire (Binasfour & Setter, 2018).

Learning Arabic with Malayalam can be confusing for children because Arabic has a different alphabetic based writing system than the alpha syllabic Malayalam. In addition, the Arabic writing progress is right to left of the page while it is in the opposite direction in Malayalam. Hence, the present study aims to understand the phonological awareness of biliterate children in comparison to monoliterate with the following objectives: (1) to understand the PA of biliterate in comparison to monoliterate (2) to assess the differences in the PA based on the complexity of the stimuli and (3) to know the developmental variation of PA from children between the age of 5 and 8 years.

2. Methodology

1.1. Participants

There were forty children from the age range of 5-8 years, including an equal number of male and female subjects who participated in the present study. Twenty participants were formally trained in both alpha syllabic (Malayalam) and alphabetic (Arabic) orthography as a part of their school curriculum with a minimum duration of three years and were considered biliterate (Group I). The other group of children was trained only in Malayalam orthography (Alpha syllabic) and were considered mono-literate (Group II). None of them had any history of speech, language, hearing or neurological deficits. All of them were tested in the presence of any of the parents, and informed consent was taken before the test session.

1.2. Stimuli

Tasks included in the present study were phoneme isolation (PI), phoneme blending (PB), phoneme deletion initial (PD-I), phoneme deletion final (PD-F), and phoneme segmentation (PS). 10 tokens of each task were prepared with an equal number of complex and simple stimuli. Complexity was decided based on the manner of articulation of the phoneme consisting in the stimuli and embedded with a minimum of 1 complex phoneme in each complex stimuli. Selected stimuli included three to four syllabic words that are common and familiar to the children in their day-to-day lives. Simple stimuli included mainly glides, liquids, and nasals, and complex stimuli included fricatives and affricates. Practice stimuli were also made with three words for each task containing simple and complex words with different number of syllables.

1.3. Procedure

Parents' consents were taken prior to the test. The entire data collection procedure was completed in thirty minutes with a five-minute break in between. Participants were asked to complete the test individually in a quiet

room. Instructions were also provided prior to each task, along with appropriate illustrations. Words for practice were administered first before the actual testing. The mistakes made by the child during the practice time were corrected. After a two-minute gap, test stimuli were administered, and the sample was stored in audio format. There was no chance for correcting errors during the administration of test stimuli. Each correct answer was scored as 1 and zero for incorrect answers

3. Findings

3.1. PA of biliterates in comparison to mono literates

As shown in Table 1 there was no considerable difference between the two groups of participants. Group 1 was children trained only in Malayalam orthography (Alpha syllabic), and Group 2 was trained in both alpha syllabic (Malayalam) and alphabetic (Arabic) orthography. Indeed, the median of phoneme isolation was the same for both groups and phoneme segmentation was better in group two than in group one. Further non-parametric inferential statistics were administered, as there was no normality among the samples. Mann-Whitney U test showed no significant difference between the two groups for all the tasks including Phoneme isolation (/Z/=0.619; p= 0.536), Phoneme Deletion-Initial (/Z/= 0.498; p= 0.619), Phoneme Deletion-Final (/Z/= 0.110; p=0.912), phoneme segmentation (/Z/=1.805; p= 0.071) and phoneme blending (/Z/= 0.684; p= 0.494). It was evident that L2 orthography did not have an effect on the L1 phonological awareness. Contrary to the assumption, L2 orthographical learning can be considered as an advantage as the results showed a slightly greater score for group 2 than 1. Such results indicate that training in L2 augments the L1 learning.

Table 1
Descriptive statistics of different tasks of PA across groups

	Group 1				**Group 2**			
	Mea	**Median**	**S.D**	**IQR**	**Mea**	**Median**	**S.D**	**IQR**
PI	94.5	100	9.98	10.0	94.0	100	7.53	10.0
PD-I	82.5	95	22.9	30.0	78.0	90	28.0	40.0
PD-F	71.5	85	28.7	60.0	74.5	80	23.5	37.5
PS	80.0	90	22.2	27.5	90.5	100	12.7	20.0
PB	89.0	95	14.8	20.0	86.5	90	15.6	20.0

* S.D= Standard Deviation; IQR= Interquartile Range

3.2. PA based on complexity of the stimuli

Table 2 shows the descriptive statistics of PA tasks based on complexity across groups. As it is shown, there was not much variation across the complexity of stimuli, which was evident in both language groups. Wilcoxon signed Rank test showed no significant difference between simple and complex categories of stimuli for all the five tasks and it was seen in both L2 Arabic and Malayalam groups with p value greater than 0.05 (Table 3).

Table 2
Descriptive statistics of different tasks of PA based on complexity across language groups

	Group I				Group II			
	Mean	**Median**	**S.D**	**IQR**	**Mean**	**Median**	**S.D**	**IQR**
PI-Simple	92.00	100	18.80	15.00	92.00	100	13.61	20.00
PI-Complex	97.00	100	7.32	0.00	96.00	100	10.46	0.00
DI-Simple	85.00	100	23.28	20.00	80.00	80.00	25.95	35.00
DI-Complex	80.00	90.00	25.95	35.00	76.00	90.00	33.46	40.00
DF-Simple	80.00	100	25.13	40.00	76.00	80.00	23.92	40.00
DF-Complex	79.00	80.00	35.70	45.00	73.00	80.00	26.17	40.00
S-Simple	82.00	100	24.19	40.00	96.00	100	10.46	0.00
S-Complex	78.00	80.00	25.04	35.00	85.00	100	21.39	35.00
B-Simple	89.00	100	15.18	20.00	88.00	100	20.92	20.00
B-Complex	89.00	100	17.74	20.00	85.00	80.00	14.32	20.00

* S.D= Standard Deviation; IQR= Interquartile Range

Table 3
Test statistics /Z/ and statistical significance p values of effect of complexity of stimuli

		PI	**PD-I**	**PD-F**	**PS**	**PB**
Malayalam	**/Z/**	1.000	1.186	1.294	0.849	0.000
	p	0.317	0.236	0.193	0.396	1.000
Arabic	**/Z/**	0.921	0.649	0.775	1.930	0.775
	p	0.357	0.516	0.439	0.054	0.439

3.3. Developmental variation of PA between 5 to 8 years

As shown in Table 4, developmental variations were seen within each language group. Tasks such as phoneme isolation and phoneme blending were correctly elicited in the younger group, i.e., 5-6 years, where phoneme deletion both in initial and final positions and segmentation were noted to be less accurate for them. However, older age group showed more than 75% accuracy for all the tasks. This trend was seen in both Alphabetic and Alpha-syllabic language groups.

For phoneme isolation, mean scores were more in alphasyllabic language than in alphabetic language. In all other tasks, such as phoneme blending, phoneme deletion-initial and final and phoneme segmentation, mean scores were higher in alphabetic language than in alphasyllabic language. With respect to age group, both 5-6 years and 7-8 years children showed the same mean scores for phoneme isolation in alphasyllabic language. For alphabetic language, the mean score for phoneme isolation was higher in the age range of 7-8 years. For all the other tasks, mean scores were higher for the older age group (7-8 years) than the younger group (5-6 years).

However, based on inferential statistics, there was no significant difference between the two age groups, i.e. 5-6 years and 7-8 years, in both alpha

syllabic and alphabetic groups. Table 5 shows the /Z/ and p values of the Mann-Whitney U non-parametric test, which was used for the comparison between the two age groups across tasks in both orthographical groups

Table 4
Descriptive statistics of different tasks of PA based across age groups

Task	**Language**	**5-6 years**				**7-8 years**			
		Mean	**Median**	**SD**	**IQR**	**Mean**	**Median**	**SD**	**IQR**
PI	**Malayalam**	95	100	7.07	10.00	95	100	7.07	10.00
PD-I		76	80	27.96	37.50	78	85	23.94	42.50
PD-F		64	75	33.39	62.50	76	85	25.03	50.00
PS		78	90	26.99	25.00	87	90	14.18	22.50
PB		84	90	18.97	32.50	81	90	19.69	35.00
PI	**Arabic**	93	95	12.64	10.00	94	100	8.23	12.50
PD-I		78	95	15.23	22.50	89	100	32.93	42.50
PD-F		73	80	22.33	32.50	79	85	23.11	35.00
PS		82	85	17.51	32.50	94	100	10.74	12.50
PB		92	90	6.99	10.00	94	95	7.88	12.50

Table 5
Test statistics /Z/ and statistical significance p values of effect of complexity in stimuli

		PI	**PD-I**	**PD-F**	**PS**	**PB**
Malayalam	**/Z/**	0.359	1.096	0.925	0.077	0.934
	p	0.720	0.273	0.355	0.938	0.350
Arabic	**/Z/**	0.548	0.510	0.498	1.288	1.107
	p	0.584	0.610	0.618	0.198	0.268

4. Discussion and conclusion

The present study had three objectives, and the first objective was to analyze the effect of learning alphabetic language orthography, i.e. Arabic, along with alpha syllabic language, i.e., Malayalam. Results / The results show no significant difference between children learning both languages simultaneously in comparison with children who learned only their native language orthography. In fact, the mean values of a few tasks were better for simultaneous learners than the other group. This can be because of the transfer effect of L2 to L1, and it is reflected in reading skills reported in previous studies (Altmisdor, 2016). Moreover, it is an agreement with the language Interdependence Hypothesis (Cummin, 1979, 1991) where the learning of any language skill in first and second languages are dependent on each other. Participants of the present study are simultaneous learners of two languages with entirely different orthographies, and that cognitive load enhances their cognitive-linguistic capacity more than a child who learns single native language orthography. In addition, Koda's (2008) transfer facilitation can be applied to explain the improved performance of children who are known to write two languages than one language. However, there can be a question of consistent enhanced performance across tasks that were not seen in children who are learning two orthographies. This can be explained as the linguistic distance effect as Arabic and Malayalam are

entirely two entities of the orthographical system. Similar results have been seen in Korean–English biliteracy acquisition (Wang, Park, & Lee, 2006).

Other objectives were to see the effect of the complexity of stimulus and developmental variation on the accuracy of phonological awareness. The present study showed no complexity effect on phonological awareness tasks in both language groups. Some of the previous studies showed contrasting findings where they had considered syllable shape (Cunningham, Witton, Talcott, Burgess & Shapiro, 2015) and word structure (Anthony & Francis, 2019) as factors to manipulate the complexity of stimuli. Instead, the present study considered articulatory characteristics to categories of simple and complex stimuli sets, and it was shown to have a positive effect on phonological awareness in a previous study (Treiman, 1984). It can be reasoned as an insignificant developmental variation where the participants acquired most of the phonological awareness tasks with more than 75% accuracy, and it consisted of simple and complex tasks.

The complexity effect would have been seen in younger participants aged less than 5 years, and it can be considered as a limitation of the study. Nevertheless, native Malayalam-speaking children learn Arabic formally by 5 years, and chances of obtaining participants below that age are minimal. Similarly, phonological awareness in other biliterates can also be investigated in the future for the process to be better understood. As a whole, the present study highlighted the non-disturbed phonological awareness skills in biliterate children where the orthographical systems were far apart, i.e., alpha syllabic (Malayalam) and alphabetic (Arabic). It supports the policy of teaching any combinations of languages in primary classes of school as it is not negatively impacted.

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Phonological development in 3-5 years old Bahdini Kurdish-speaking children

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Abstract

Studying phonological development is crucial for understanding linguistic patterns, supporting language perservation, educational development and clinical practice. There is lack of sufficient research about phonological development in the Kurdish language. The aim of this study is to examine the phonological development in typically developing Bahdini Kurdish (BK)-speaking children. The analysis uses the quantitative phonological development metrics that assess the correctness of a single segment such as Percentage of Consonant Correct (PCC), Percentage of Vowel Correct (PVC) and Percentage of Phoneme Correct (PPC) and those that evaluate the whole words abilities instead of mere segments such as Phonological Mean Length of Utterance (PMLU), Proportion of Whole-Word Proximity (PWP) and Proportion of Whole-Word Correctness (PWC). The study assessed 54 monolingual BK-speaking children aged 3 to 5 years randomly selected from kindergartens in Zakho city. The assessment was carried out using the Bahdini Kurdish Articulation Test (Ahmed & Hasan, 2022). The results show that the mean score of segmental phonological accuracy measures for PCC is 89.36, for PVC 96.35 and for PPC 93.66. The whole-word skills mean score measures for PMLU is 6.99, for PWP 0.93 and for PWC 0.71. These scores show low rates of phonological metrics which indicate that phonological development is later in BK children in comparison to that of other languages. There is a significant effect of age on these measures, while no effect of gender is observed. The study of phonological development of BK is significant for cross-linguistic research or practical applications in speech pathology. İt presents valuable opportunities for empirical and theoretical contributions to the broader understanding of human language and cognition.

Keywords: phonological development, Bahdini Kurdish, phonological accuracy, whole-word abilities, phonological metrics

1. Introduction

Phonological development or phonological acquisition is a critical aspect of language acquisition in children, involving the gradual mastery of the sound system of a language. It focuses on how children acquire the phonological system of the ambient language(s), learn the phonological rules, produce contrasts between phonemes and combine these phonemes in

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words (Saaristo-Helin, 2011). Although, there are distinguishable phases in phonological development (e.g. the prelexical period and the first word period), differences among children acquiring the same language make it challenging to define clear-cut developmental stages (Saaristo-Helin, 2011).

Phonological development has been analyzed using different qualitative and quantitative methods. Qualitative methods involve phoneme inventory analyses (e.g. Stoel-Gammon, 1985), the analysis of word templates produced by the child (Menn, 1983; Vihman, 2010) and the analysis of phonological processes in the child's speech (Ingram, 1981; Grunwell, 1987). Quantitative analyses measure the child's progress using some quantitative metrics. Several assessment tools for measuring children's phonological development have been proposed. Some of them are segment oriented, i.e. they only assess the correctness of a single segment such as: Percentage of Consonant Correct (PCC), Percentage of Vowel Correct (PVC) and Percentage of Phoneme Correct (PPC) or a number of segments in a sequence such as Percentage of Consonant Cluster Correct (PCCC). Other methods evaluate the whole words instead of mere segments, such as: Phonological Mean Length of Utterance (PMLU), Proportion of Whole-Word Proximity (PWP) and Proportion of Whole-Word Correctness (PWC). These metrics are increasingly important because the child's results can easily be compared to those of others and they provide a useful method for evaluating improvement in therapy (Saaristo-Helin, 2011). They are also used for understanding phonological development in children with phonological disorders, accurately diagnosing them and tracking their progress (Huneety et al., 2024). Additionally, they can work as universal or as language independent metric of phonology (Saaristo-Helin, 2011). This study will analyze the phonological development in Bahdini Kurdish (BK) using the quantitative segmental (PCC, PVC and PPC) and whole-word (PMLU, PWP, PWC) measures.

PCC, PVC and PPC are important in the documentation of children's phonological accuracy (Dodd et al., 2003; Fatemi-Syadar et al., 2018; McLeod & Crowe, 2018; Zarifian et al., 2014; Zarifian et al., 2013). The PCC, also known as the Articulation Competence Index (ACI) (Syadar et al., 2018), serves as an index of severity of involvement that reflects three aspects of phonological disorder in children: disability, intelligibility and handicap (Saaristo-Helin, 2011). To measure PCC, the number of consonants produced correctly in a child's production is divided by the total number of consonants and then that sum is multiplied by 100 to obtain a percentage (Shriberg et al., 1997). Only correctly articulated consonants are scored as correct on the PCC, while cases of consonants deletion or substitution are scored as incorrect (Shriberg et al., 1997). The PVC is another metric that computes the number of vowels and diphthongs produced correctly. Like PCC, cases of vowels deletion and substitution are considered incorrect (Shriberg et al., 1997). The PPC reflects the percentage of both consonants and vowels/diphthongs articulated correctly (Dollaghan et al., 1993).

Whole-word phonological measures not only evaluate single segments but also all the segments that constitute the child's target word. PMLU is a diagnostic and clinical criterion in phonological development used for assessing whole-word complexity for both words targeted by the children and words that the children produce. It can be calculated out of the utterance

sample of the child's transcribed speech sample. It is scored by calculating all consonants and vowels of the child's produced words and those of the target words (standard production of words in native adults) individually. Since languages are distinctive in syllabic and phonological structures, PMLU is studied as a language-specific measure. In its earliest forms, PMLU evaluates four features of children's phonological development: proximity, complexity, correctness and variability (Karimian, Mohammadi, Bemani, Kazemi & Kianfar, 2022). Proximity indicates the correctness of the word: when the child produces the word correctly, the proximity ratio of the whole word becomes one. Complexity deals with the phonetic complexity of a child's productions. According to Stoel-Gammon (2010), complexity has three domains: word patterns (words with more syllables are generally considered complex), syllable structures (syllables with consonant clusters are complex) and sound classes (words that include less common or more difficult-to-produce or late acquired sound classes are considered complex). Correctness reflects the correct production of all components (consonants and vowels) of the word chain. Variability shows how children produce words independent of their phonological form (Ingram, 2002). The basic idea of this measurement is that children target whole words during the very early stages of phonological development and show little awareness of the segments in the words they are targeting and producing (Ingram, 2002). The PWP is another phonological quantitative measure scored by the ratio of the produced PMLU to the targeted word PMLU. PWP identifies speech intelligibility indirectly (Ingram, 2002; Babatsouli et al., 2014). It reflects the degree of accuracy in the words, for instance, if a child produced all words entirely correctly, the child would receive a PWP score of 1.0 (Saaristo-Helin, 2011). The PWC is measured simply by calculating the total number of words that the child produces correctly divided by the total number of words in a sample. For instance, if a child produced 75 words entirely correct from a sample of 100 words, the PWC value would be 75/100=0.75, that is 75%.

These quantitative measures have been applied to a variety of languages (Ingram, 2002; Karimian et al., 2022), used to assess sample utterances of monolingual or bilingual speakers (Bunta et al., 2009), normal or phonologically impaired children across languages (Archana et al., 2011; Huneety et al., 2024). No studies have assessed the phonological development in BK-speaking children using segmental and whole-word production metrics. This study is the first attempt to examine the phonological development in typically developing monolingual BK-speaking children using both segmental and whole-word measures. Both types of measures are useful means to evaluate children's phonological abilities. Detailed knowledge about phonological development in children acquiring Kurdish or any other language provides important information for the assessment of whether a child's speech is typical, delayed or disordered (Fatemi-Syadar et al., 2021, Huneety et al., 2024).

A few studies on phonological development in Kurdish exist to date. These studies had used qualitative methods (as the study of phonological processes in the child's speech (for BK Ahmed, 2023) or the acquisition of consonant phonemes (for Central Kurdish Karzan & Sherwan, 2021) and qualitative methods that were found only for some dialects of Kurdish

(Mukryani subdialect of Central Kurdish by Fatemi-Syadar et al, 2018 and Fatemi-Syadar et al. 2021). The qualitative analysis involved Ahmed (2023) who evaluated the phonological development of 48 BK children aged 3-5 years old and identified the common phonological processes used in the first stages of their language acquisition. The study was carried out using the Bahdini Kurdish Articulation Test (Ahmed & Hasan, 2022). The results showed that the children showed 19 different patterns during the time frame understudy. The most commonly used process was cluster reduction while the least used one was reduplication. No gender differences in the number and types of phonological processes had been found, while significant differences between age groups were observed (Ahmed, 2023). In her study, Ahmed (2023) also examined the consonant and vowel production accuracy. It was found that vowels were fully acquired before the age of 3, while some consonants were fully acquired before age 3, there were difficulties in mastering some consonant sounds in the three age groups under study and some consonants did not reach the mastery level even after age 5 (such as b, g, v, ɣ and j/. Similaarly, Karzan & Sherwan (2021) investigated the acquistition of consonant sounds by 15 Central Kurdish speaking children aged 2:1-6:5 years old. The study used picture-naming method to elicit words containing the Kurdish consonants in three word positions: initial, middle aand final. The results showed that the children acquired most consonants between age 4:6, and the sounds /s,z, ʃ, l, ɬ, r, ɾ/ were acquired lately in Kurdish. Quantitative analysis involved Fatemi-Syadar et al. (2018) who analyzed the normal development of PCC in terms of articulation and position of sound in the word. In their study, 120 Mukryani Kurdish-speaking children aged 3-5 years were evaluated by a Kurdish phonetic test. The results showed that the PCC increased with age and did not show any significant gender differences. It was also found that PCC was related to the manner of articulation (the children were accurate in the pronunciation of nasal, glide, lateral, stop and flap than fricative, affricative and trill consonants) and the position of sound in words (consonants in the initial position were produced better and were more precise than consonants in the medial and final position). Similarly, Fatemi-Syadar et al. (2021) examined the phonological acquisition in 120 typically developing children speaking Mukryani subdialect of Central Kurdish using the Kurdish Speech Test. Their analysis focused on the age of consonants acquisition, phonological accuracy, phonological patterns and the effect of age and gender on speech sound acquisition. The results found that Kurdish-speaking children had acquired all the vowels before 3;0 and all the consonants in the three positions (initial, medial and final) up to 4;6 years old. Consonant production in initial position was more accurate than in medial and final positions. The accuracy of Kurdish vowels and consonants improves with increasing age as phonological patterns decrease. There was no significant gender difference within the age groups.

The findings of these studies cannot be confidently generalized to other dialects and accents of Kurdish because there are phonological differences between the dialects of Kurdish. For example, there are differences in the phonemic inventory of BK and other dialects of Kurdish, for instance, The aspirated sounds / p^h, t^h, k^h, $tʃ^h$/ and pharyngealized plosive /$t^ʕ$/ are

phonemic in BK, while velar nasal /ŋ/ and velarized lateral /ɬ/phonemes are only found in Sorani dialect (Hasan, 2012; Öpengin, 2020). The long vowels /u: and o:/ are found in BK (Khan & Salih, 2017) but not in Central Kurdish (Hamid, 2015).

This study aims to investigate and document phonological accuracy (including PCC, PVC, PPC) and whole-word abilities (including PMLU, PWP and PWC) in BK children aged 3-5.

In this study, three questions are answered:

1- What is the phonological accuracy for BK typically developing children?
2- What are the whole-word abilities for BK typically developing children?
3- Is there a gender and age effect on phonological accuracy and whole-word phonological abilities?

This study can be used as a basis for quantitative studies in the field of children's phonological assessment in BK. It provides a detailed understanding of how Kurdish-speaking children acquire and develop their phonological systems. It highlights the unique aspects of the Kurdish language and how they shape phonological development, contributing to broader theories of language acquisition.

1.1. Kurdish Language

Kurdish is an Indo-European language belonging to the Western Iranian language group of the Indo-Iranian branch family. It is spoken by people living mainly in Turkey, Iran, Iraq and Syria.

Kurdish is divided into three main dialects: Northern Kurdish (more widely known as Kurmanji), Central Kurdish (also known as Sorani and middle Kurmanji) and Southern Kurdish (also known as Kelhori, Khwarû or Pehlewani) (Kasap, 2021; Hasan, 2012). Northern Kurdish is spoken by the majority of the Kurdish population mainly in Turkey, Syria, north east of Iraq, Armenia, Azerbaijan, and northern Khurasan in Iran. The major subdialects of this dialect are Bahdini, Adyamani (Marashi), Bekrani, Birjendi, Botani, Bayezidi, Hekari, Jiwanshiri, Qocani, Senjari, Urfi, Yuneki (Judikani) and Surci. Orthographically, it has different writing systems: a modified Turkish Latin alphabet, Cyrillic letters and a modified Arabic alphabet (Thackston, 2006; Hassani, 2018). Central Kurdish is spoken in Iran and northeast part of Iraq. The major subdialects of this variety are Mukri, Erdelani, Germiyani, Sorani, Xushnaw, Pijdar, Pirani, Wermawe and Hewleri. Southern Kurdish predominates both in Iraq and Iran, in an area from Shehreban to Dinewer, Hemedan, Kirmashan and Xanekin all the way to Mendeli and Pehle and it is also the language of the populous Kakay tribe near Kerkuk and the Zengenes near Kifri. The subdialects of this variety are Bajelani, Kelhiri, Gurani, Mankili, Kenduley, Senjabi, Zengene, Kakayi and Kirmanshani. In this study, the Bahdini subdialect, spoken in Duhok, Zakho, Amedi and Akre cities of north of Iraq, of Northern Kurdish is understudy and the Kurdish words will be written in the modified Turkish Latin alphabet.

BK has 32 consonants which include 11 plosives /p/, /pʰ/, /b/, /t/, /tʰ/, / ʈ/, /d/, /k/, / kʰ/, /ɡ/, /q/, 11 fricatives /f, /v/, /s/, /z/, /ʃ/, /ʒ/, /x/, /ɣ/, /h/, /ħ/, /ʕ/, three affricates /ʧ/, / ʧʰ /, /ʤ/, two nasals /m/, /n/, an alveolar lateral /l/ one flap /ɾ/, one trill /r/, and two glides /w/, /j/ (Hasan, 2012). /ʔ/ is not a phoneme in BK but is an epenthetic sound in BK that is inserted by the speakers to avoid onsetless syllables and to avoid vowel clusters (Hasan & Mohammed, 2023). The manner and place of articulation of the BK consonants are shown in Table 1.

Table 1
The consonant system of Bahdini Kurdish

	Bilabial	**Labiodental**	**Alveolar**	**Palato-alveolar**	**Palatal**	**Velar**	**Uvular**	**Pharyngeal**	**Glottal**
Fricatives		f v	s z	ʃ ʒ		x ɣ		ħ ʕ	h
Plosives	p b pʰ		t tʰ ʈ d			K kʰ g	q		
Affricates				ʧ ʧʰ ʤ					
Nasals	m		n						
Flap			ɾ						
Trill			r						
Lateral			l						
Approximants	w				j				

All consonants are produced in initial, medial and final position with the exception of /ɾ/ (medial and final only) and /h, pʰ, tʰ, kʰ, ʧʰ / (initial and medial only). BK has eight simple vowels: three short vowels /a/, / ɨ /, /~~ʉ~~ / and five inherently long vowels /ɑ:/, /i:/, /e/, /o/, and /u:/ (Bijankhan & Saleh, 2017). Table 2 shows the BK vowels. The majority of vowels occur in only two positions (middle and final), with the exception of two vowels /o/ and / ɨ / which never occur in the final position of words. Of these vowels, the short vowel / ɨ / has a special significance in syllable construction. It is very unstable, so that when it is located between two consonants, in particular in unstressed syllables, it is often indistinguishable by ear. The vowel / ɨ / has been compared to the schwa in English.

Table 2
The vowel system of Bahdini Kurdish

	Front	**Central**	**Back**
Close	i: ɨ		u: ~~ʉ~~
Mid-close	e		o
Mid-open	a		
Open			ɑ:

As for diphthongs, there is a disagreement about whether Kurdish has diphthong vowels or not. Studies do not include diphthongs in the vowel inventory claiming that they are combinations of a vowel + glide and that there are no minimal pairs between the diphthongs given in previous studies and the monophthongs (Hamid, 2015).

Regarding the syllable structure, BK has fewer syllable types and the consonant clusters, can include up to three segments in the initial and two

in the final parts (Shokri 2002; Hasan 2009; Ali & Abdulla, 2019). The vocalic element is the central obligatory element in a syllable, while the non-vocalic elements are optional (Marif, 1976; Shokri, 2002). Shokri (2002) identifies the following syllable patterns for BK: V (as in e /ɛ/ 'yes'), VC (as in av /av/ 'water'), CV (as in ba /ba/ 'wind'), CCV (as in trî /tri:/ 'grapes'), CVC (as in ber /bɛr/ 'stone'), CCVC (as in brîn /bri:n/ 'cut'), CVCC (as in dest /dɛst/ 'hand'), VCC (as in ərd /ɛrd/ 'floor') and CCVCC (as in stêng /steng/ 'wasp') (V stands for vowel and C for consonant). Ali and Abdulla (2019) further add CCCV as in strî /stri:/ 'thorn' and CCCVC as in stran /stra:n/ 'song'. However, vowel-initial syllable structures are not allowed in BK either word-initially or medially, because they are pronounced with a glottal stop that is not part of the phonemic structure of the syllable, i.e., not a true consonant but is inserted to fill the onset position (Hasan and Mohammed 2023). Kurdish is a phonetic language because it is written as it is pronounced.

2. Methodology

This study employs a quantitative approach to investigate the phonological development of native BK-speaking children aged 3 to 5 years. The methodology is designed to systematically examine the effects of age and gender on phonological accuracy and whole-word abilities, utilizing structured data collection and analysis techniques. The study relies on the Bahdini Kurdish Articulation Test (BKAT) (Ahmed & Hasan, 2022), a reliable and culturally appropriate tool, to assess speech sound production. The following sections detail the participant selection, procedures, and data analysis methods used to ensure a rigorous and objective evaluation of phonological development in BK-speaking children.

2.1. Participants

The data of the present study were collected from 54 native BK children including both genders and spanned in age from 3 to 5 years. The children lived in Zakho, Duhok province of Kurdistan Region of Iraq. Both genders were included in the study in order to examine the effects of gender. Age groups 3, 4, 5 were chosen because it was considered to be the most suitable age groups for the aims of the study *considering that children under age 2 have limited vocabulary and often unintelligible speech, making it impractical for them to name all test images.* The participants were grouped into three age bands with 18 participants in each age group. The demographic characteristics of the participants is given in Table 3.

Table 3
Demographic characteristics of participants according to Age and gender

Age (in months)	Gender (%)		Mean (in months)	SD
	male	female		
36-47 (n=18)	10 (56)	8 (44)	41	3.6
48-59 (n=18)	9 (50)	9 (50)	54	3
60-71 (n=18)	11 (61)	7 (39)	66	3

The subjects were recruited from day-care centres and kindergartens in Zakho with the permission of their caregivers, parents and teachers using the simple random sampling in which individuals from larger population with an equal chance were selected to have unbiased and more accurate results (Cohen et al., 2007). A written consent for the children to participate in the study was provided by the parents. A demographic and health information was collected about the participants from the parents, caregivers and kindergarten teachers. The inclusion creteria included: monolingual BK Kurdish-speaking children aged three to five years with parents speaking BK as their first language, had no developmental delays and no difficulties with their hearing, visual abilities, speech or other language related issues.

2.2. Procedures and stimuli

A single-word sampling instrument, the Bahdini Kurdish Articulation Test (BKAT) was used in this study (Ahmed & Hasan, 2022). BKAT is a reliable and valid tool for the evaluation of speech sounds in BK speaking children aged 3-5 years old. The test was a picture naming task of 85 stimulus words that represent all the consonants in initial, medial and final word positions (except p^h, t^h, k^h, $ʧ^h$, ṭ because of their limited occurrences) and the vowels in word medial position only (because of their restricted distribution). The pictures are familiar to young children and culturally appropriate. The test was presented to 65 normal (38 males and 27 females) Bahdini Kurdish-speaking children. The test was evaluated by experts in phonetics and phonology who approves its validity to measure the articulation capabilities of the children. The content validity of the test was measured in its application to the children and it was found that there is a significant and high correlation between correct word utterances and picture identification. The test is adopted to ensure that virtually all possible phonemes and phoneme combinations are tested. Such tests are used extensively to quantify and evaluate the children's phonological abilities in many languages (for Danish by Clausen & Fox-Boyer, 2017).

The participants were tested individually for 10-20 minutes in a quite room in their kindergarten and caregiver centers. The test was presented to the children and their responses were audio recorded using a phone voice recorder application. In most cases, familiar people remained in the room where they were asked to stay without any attempts to help the child to say the intended word. The examiner would ask 'What is this?' and the child would reply by naming the picture. However, in the cases, where the subjects did not name the picture spontaneously or correctly, some additional cues or hints were provided including some other questions and showing the real object of a particular pictured word that can be found in that particular place or showing other similar items.

2.3. Data analysis and measurements

Children's speech samples were listened to and transcribed narrowly using the conventions of the International Phonetic Alphabet (IPA) by the second author, a native BK speaker and a linguist. The recorded speech samples of 11 children (20% of the data) were randomly selected and independently transcribed by the first author, also a native BK speaker and

a linguist to get the inter-rater reliability. The results showed that the mean percentage of agreement between the two transcribers was (98%). The discrepancies between the two transcriptions were resolved through discussion.

Then, the speech production was analyzed to document the phonological accuracy and whole-word abilities. For phonological accuracy, the measurements of PCC, PVC and PPC were obtained as follow:

1- PCC was obtained by dividing the number of correct consonants by the total number of consonants in the sample multiplied by 100.
2- PVC was calculated by the percentage of accurate vowels divided by the total number of vowels in the sample multiplied by 100.
3- PPC was measured by dividing the number of correct consonants and vowels by the total number of consonants and vowels in the sample multiplied by 100.

The children whole-word abilities are measured using PMLU, PWP, PWC, as follow:

1- $PMLU_{target}$, for each target word, the number of segments (consonants and vowels) was counted and summed with the number of consonants in a word,
2- $PMLU_{child}$ for the child production, the number of segments is summed with the number of correct consonants produced.
3- PWP is derived by dividing the ratio of the child produced $PMLU_{child}$ to the targeted word $PMLU_{target}$
4- PWC is calculated by the total number of words that the child produces correctly divided by the total number of words in the sample.

The number of phonemes in the target speech sample is 388 (242 consonants and 146 vowels). The target PMLU is 7.412.

To compare the performance among age groups and genders with regard to the phonological measurements, mean scores were calculated. The statistical tests of Kruskal-Wallis H test is used to compare means scores of age, Post-Hoc Dunn's test is performed for multiple comparisons of age groups and one-tailed t test are used to compare mean scores according to gender.

3. Findings

3.1. Phonological accuracy

The mean values of the phonological accuracy metrics PCC, PVC and PPC of the BK-speaking children by age is shown in Table 4. The older children performed more accurately than the younger on all phonological accuracy measures, however, the difference in the PVC across the ages is not high.

Table 4
PCC, PVC and PPC mean correct percentages and SD by age group

Age group	PCC	PVC	PPC
	Mean % (SD)	**Mean % (SD)**	**Mean % (SD)**
36-47 (n=18)	84.02 (6.93)	96.28 (1.85)	90.67 (4.82)
48-59 (n=18)	91.28 (5.89)	96.29 (1.36)	94.72 (3.84)
60-71 (n= 18)	92.78 (2.72)	96.49 (1.38)	95.58 (1.65)
Whole groups	**89.36 (4.68)**	**96.35 (0.11)**	**93.66 (2.61)**

The table shows the mean PCC for age 3-5 children is 89.36 and that of PVC and PPC are 96.35 and 93.66 respectively.

3.2. Whole-word abilities

The mean scores of the whole-word abilities measures PMLU, PWP and PWC of the BK-speaking children by age are presented in Table 5. The results show an increase in the values of PMLU, PWP and PWC as the age increases.

Table 5
Mean vales (SD) of PMLU, PWP and PWC by age group

Age groups	PMLU	PWP	PWC
	Mean (SD)	**Mean (SD)**	**Mean (SD)**
36-47 (n=18)	6.77 (0.37)	0.89 (0.09)	0.56 (0.16)
48-59 (n=18)	7.07 (0.18)	0.95 (0.02)	0.76 (0.11)
60-71 (n=18)	7.12 (0.13)	0.95 (0.01)	0.80 (0.07)
Whole groups	**6.99 (0.18)**	**0.93 (0.03)**	**0.71 (0.12)**

The table shows that the mean PMLU for age 3-5 children is 6.99, PWP is 0.93 and PWC is 0.71. There is an increase in the PMLU, PWP and PWC values by age, however PWP in age 4 and 5 has the same mean score.

3.3. Age

To examine whether the differences in the measures of phonological accuracy and whole-word abilities across age groups are significant, we performed the test of Kruskal-Wallis H to show whether the difference is significant and the Post-Hoc Dunn's test using a Bonferroni corrected alpha of 0.017 was performed to examine whether the difference was significant across successive age groups.

For phonological accuracy measures, the results of the Kruskal-Wallis H test show significant differences in the PCC (X^2=16.98, p<.001) and PPC (X^2=13.43, p<.001) measures but not in the PVC (X^2=0.34, p=.844). The result is significant at p<.05. The results of Post-Hoc Dunn's test, generally, show that the mean ranks of PCC and PPC are significant between age group 3 & 4 and 3 & 5, but not between the age group 4 & 5. While mean ranks of PVC is not significantly different across all successive age groups, as it is shown in Table 6.

Table 6
Mean PPC, PVC and PPC scores across successive age groups

Metrics	Age groups	Mean Rank difference	Z	P-value
PCC	3 & 4	-17.9167	3.4172	0.0006328
	3 & 5	-19.4167	3.7032	0.0002129
	4 & 5	-1.5	0.2861	0.7748
PVC	3 & 4	1.5278	0.2915	0.7707
	3 & 5	-1.5278	0.2915	0.7707
	4 & 5	-3.0556	0.5829	0.56
PPC	3 & 4	-16.2778	3.1054	0.001901
	3 & 5	-16.9722	3.2378	0.001204
	4 & 5	-0.6944	0.1325	0.8946

As for whole-word abilities measures, the results of the Kruskal-Wallis H test show that difference in all values between all age groups is significant (for PMLU, X^2= 15.04, p<.001), for PWP X^2= 14.11, p<.001, for PWC, X^2= 19.26, p<.001). The result is significant at p<.05. The results of the Post-Hoc Dunn's test show that the mean ranks of PMLU, PWP and PWC are significant between age group 3 & 4 and 3 & 5, but they are not significant between the age group 4 & 5, as it is indicated in Table 7.

Table 7
Mean PMLU, PWP and PWC scores across successive age groups

Metrics	Age groups	Mean Rank difference	Z	P-value
PMLU	3 & 4	-16.4167	3.1332	0.001729
	3 & 5	-18.5833	3.5467	0.0003901
	4 & 5	-2.1667	0.4135	0.6792
PWP	3 & 4	-16	3.0805	0.002066
	3 & 5	-17.6667	3.4014	0.0006704
	4 & 5	-1.6667	0.3209	0.7483
PWC	3 & 4	-18.1111	3.4589	0.0005423
	3 & 5	-21.3056	4.069	0.00004721
	4 & 5	-3.1944	0.6101	0.5418

3.4. Gender

This section examines the gender differences in the values of the phonological accuracy and whole-word abilities scores. We performed the one-tailed t test to show whether the difference is significant or not.

For phonological accuracy measures, the male participants have higher mean rates of PCC and PPC, while in PVC the females scored slightly higher. Table 8 shows the measurement of PCC, PVC and PPC for all the participants with regard to gender.

Table 8
PCC, PVC and PPC mean percentages of each age group by gender

Age groups	Gender	PCC	PVC	PPC
		Mean % (SD)	**Mean % (SD)**	**Mean % (SD)**
36-47 (n=18)	Male (10)	84.89 (8.42)	96.12 (2.09)	91.28 (6.03)
	Female (8)	82.92 (4.78)	96.48 (1.61)	89.91 (2.92)
48-59 (n=18)	Male (9)	93.02 (3.63)	96.66 (1.48)	95.87 (2.12)
	Female (9)	89.53 (7.33)	95.93 (1.21)	93.56 (4.88)
60-71 (n=18)	Male (11)	92.89 (3.37)	96.21 (1.52)	95.48 (1.96)
	Female (7)	92.61 (1.40)	96.92 (1.11)	95.74 (1.12)
Whole groups	**Male (30)**	**90.27 (4.65)**	**96.33 (0.29)**	**94.21 (2.54)**
	Female (24)	**88.35 (4.95)**	**96.44 (0.49)**	**93.07 (2.94)**

The table shows that there are differences in the performance of males and females, however, the results of the one-tailed t test showed no significant differences in the comparison of the males and females in all measures across age groups (for PCC t=-1.12573, p=.132724; PVC t=0.19774, p=.422011; PPC t=-1.10583, p=.136994). The result is significant at p<.05.

Regarding the whole-word abilities measures, the general results of the whole groups show that females are better than males in the measures of PMLU, PWP, but males are better in PWC. Table 9 presents the mean scores of these measures across gender.

Table 9
The mean scores and SD of PMLU, PWP and PWC of each age group by gender

Age groups	Gender	PMLU	PWP	PWC
		Mean (SD)	**Mean (SD)**	**Mean (SD)**
36-47 (n=18)	Male (10)	6.71 (0.45)	0.87 (0.11)	0.58 (0.21)
	Female (8)	6.85 (0.24)	0.92 (0.03)	0.54 (0.1)
48-59 (n=18)	Male (9)	7.11 (0.13)	0.95 (0.01)	0.8 (0.08)
	Female (9)	7.03 (0.21)	0.94 (0.02)	0.73 (0.14)
60-71 (n=18)	Male (11)	7.11 (0.17)	0.95 (0.02)	0.79 (0.09)
	Female (7)	7.13 (0.05)	0.96 (0)	0.81 (0.04)
Whole groups	**Male (30)**	**6.98 (0.22)**	**0.92 (0.04)**	**0.72 (0.12)**
	Female (24)	**7 (0.14)**	**0.94 (0.01)**	**0.69 (0.13)**

The table shows that there are differences in the performances of males and females in all the measures. However, the results of the one-tailed t test showed no significant differences in the comparison of all the measures in the males and females in all age groups (for PMLU t=0.25727, p =.398995, for PWP t=0.83238, p=.2045, for PWC t=-0.78138, p=.21906).

4. Discussion

This study analysed the phonological development in BK-speaking typically developing children aged 3-5 years using segmental and whole-word measures. The mean score of segmental phonological accuracy measures for 3-5 years BK-speaking children for PCC is 89.36, for PVC 96.35 and for PPC 93.66. The whole-word skills mean score measures for PMLU is 6.99, for PWP 0.93 and for PWC 0.71. There is a significant effect of age on the scores of these measures (except PVC), while no gender effect is observed.

The phonological development in BK seems slightly later than that of other languages. BK has low rates of phonological accuracy measures in comparison to other languages. McLeod and Crowe (2018) in their review of studies on 27 languages stated that by age 5 children produced at least 93% of consonants correctly (PCC), an average PVC of 98.02% and PPC of 96.92. In British English, the mean scores of PCC, PVC and PPC for 3-6:11 normally developing children are 90.81, 98.72 and 93.63 respectively (Dodd et al., 2003). For Danish, the mean scores of PCC and PVC for children aged 2:6-4:11 range from 85.89-98.54 and 93.07-98.84 respectively (Clausen & Fox-Boyer, 2017). In Mukryani dialect of Kurdish, the mean percentage of correct consonant production of children aged 5 was 93.9% (Fatemi-Syadar et al, 2018) and in another study the mean percentages of PCC, PVC and PPC of 3-5 aged children were 91.22, 98.86 and 94.17 respectively (Fatemi-Syadar et al, 2021). The difference can be due that the phonology of BK is acquired later than that of other dialects of Kurdish and other languages as by age 5 the BK children have not fully mastered a number of consonants and the phonological processes are still prevalent (Ahmed, 2023). In addition, the PCC low values might be that BK does contain consonants which have been described as being late acquired speech sounds such as affricates and voiced fricatives (see Dodd et al, 2003; Fox, 2006). The less accurate vowel production might be due to the vowel system of BK which is characterized by vowel qualities that are very close to each other, thus poses a challenge for young children and hard to learn. This claim is supported by Clausen and Fox-Boyer (2017) for Danish who also reported low PVC for Danish in comparison to other languages.

Similarly, BK has low whole-word measures in comparison to other languages. PMLU reflect the phonological structure and complexity of utterances which is language-specific. Different languages have varying phonological structures including differences in the number and types of phonemes, syllable structures and the rules for combining sounds. Besides, they vary in the complexity of their word structures, i.e. some languages allow complex consonant cluster while others do not. This affects the potential maximum PMLU in different languages. BK has a relatively low complex syllable structure and low number of complex consonant clusters in the onset and coda (Hasan, 2024). The longest words in the sample has a target PMLU of 13 in <pirteqal, pelatînk> /pirtaqal, pala:ti:nk/ ‘orange, butterfly’, the shortest words < şe, av> /se:, a:v/ ‘ three, water’ have a target PMLU of 3 and the mean is 7.412. Thus, BK has a relatively low PMLU in comparison to other languages due to its phonological structure and complexity of the utterances. As for proximity, the rates of whole-word proximity are very low in BK in comparison to other languages. In American

English, in typically developing 36 months old children the PWC reaches 94% (Watson & Terrel, 2012). Additionally, the PWP in 48 to 60 months old Persian-speaking children with Isfahani accents was 0.99 (Karimian et al, 2022). This suggests that BK speaking children pronunciation is close to the adult target, but still not identical because of the segments' incorrectness. Also PWC rates are very low 0.71 in comparison to other languages (for Instance in Jordanian Arabic typically developing children age 5 and the rates were 92-94 (Huneety et al., 2024)). This shows that the BK children cannot produce all the words correctly due to the high rate of phonological errors they produce in their speech. Thus, it can be deduced that BK speaking children are late in the acquisition of segments and in their whole-word phonological abilities.

Age is a crucial factor in the progress of typically developing children (Huneety et al., 2024). The results show that the older children have significantly higher scores in segmental and whole-word abilities phonological metrics, except for PVC, than the younger groups. This suggests that children's phonological system is in progress and that speech errors might need some time to be suppressed. The results also revealed that there is a high significant difference between age groups 3 & 4 and 3 & 5 suggesting rapid growth in the phonological development in 3-4 year old typically developing children in comparison to age group 4-5. Huneety et al (2024) for Jordanian Arabic, Dodd et al. (2003) for British English also indicate that phonological skills develop with age, so older children have more accurate speech and fewer error patterns in their speech. This result is also supported by Ahmed (2023) in her analysis of the phonological processes in BK in that children's use of phonological processes declines gradually as they grow older because as children get older they master those sounds they found to be challenging at first and as a result their pronunciation gets better which leads to less sound errors in their speech. The acquisition of vowels is assumed to be complete before the age of three in BK (Ahmed, 2023), however, the results of this study indicate that the acquisition of the vowels continues after the age of three. Ahmed (2023) analysed vowel production in monosyllabic words and the children fully mastered all the vowels before age 3. In this study, it seems that the children have mastered the vowels, but they have difficulties in producing them in long and more complex words as they undergo deletions and substitutions because of the context. These difficulties seem not to be resolved in the age span under study. Similarly, James (2001) argued that the acquisition of vowels continues after the age of three and Allen and Hawkins (1980) found that children mastered vowels in stressed syllables by 3 years of age but did not master vowels in unstressed syllables until they were 4–5-years-old.

The study showed that gender had no influence on the accuracy and whole-word phonological measures of any age group. There are differences between males and females in some metrics, but the difference is not significant. The influence of gender on phonological development is inconclusive. The findings of this study support those of Zarifian and Fotuhi (2020) for Persian and Fox (2006) for German-speaking children, Maphalala et al (2014) for Xhosa-speaking children and Clausen and Fox-Boyer (2017) for Danish that also did not show any significant difference between females

and males. Amayreh and Dyson (1998) found no significant differences between the performance of females and males, but generally reported better performance of females than males. The results of this study are not in alignment with those of Phoon et al. (2014) investigating Malay and Dodd et al. (2003) investigating English, which found that females performed better than males in the older age groups.

These metrics are often used together to provide a comprehensive picture of a child's phonological development and to identify specific areas where they need more support. They can be used to track progress over time or to compare development across different children. This stuy is limited to BK. Phonological development can vary significantly across dialects and regions, thereforefore comparing phonological development in BK with other Kurdish dialects could highlight universal versus laanguage-specific patterns.

5. Conclusion

The study investigated phonological development in typically developing BK speaking children age 3-5 using segmental and whole-word measures. The results of the study have important implications for educators and speech therapists working with Kurdish-speaking children. Understanding the typical phonological development in Kurdish can help in the early identification of speech and language disorders. This knowledge can inform the development of teaching materials and intervention strategies that are culturally and linguistically appropriate. Additionally, the findings underscore the need for further research on Kurdish phonology particularly in the context of its dialectal diversity, speech disorder and the multilingual environments in which the Kurdish children are raised.

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Gestural augmentation in facilitating tense marker use: a pre-post comparison

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Abstract

Gestures are a part of unaided Augmentative and Alternative communication (AAC). They are more socially acceptable and are augmented along with speech by both typically developing (TD) and individuals with intellectual disability (ID). Hence, an attempt was made to examine how these gestures can be implemented as an augmentative aid. More specifically, we examine how gestures improve the comprehension and expression of tense markers for a Kannada-speaking 10.7 year-old male diagnosed with Spoken Language Disorder secondary to Borderline Intellectual Functioning. A case study design was employed as the intention was to bring in improvement in the target behaviour and not the efficacy of the gestural augmentation. Gestural mode was introduced as an augmentation along with the auditory verbal mode using elementary therapeutic procedures to improve the comprehension and expression of the targeted six verbs. A total of 8 sessions were required to train the comprehension and expression of tense markers. Gestural mode was introduced after the first four sessions, since the child exhibited difficulty in the comprehension of tense markers when the speech language pathologist solely used the auditory verbal modality. The child's responses were documented in terms of percentage of consistency for both comprehension and expression of tense markers. An improvement was observed in comprehension and expression of the tense markers within four sessions of introducing gestures as an augmentative mode. The average pre-therapy percentage for comprehension of past and future tense markers was 20 %, and the average post-therapy percentage for the same was 80%, whereas the expression showed an

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improvement from the average pre-therapy percentage of 0 % to an average post-therapy percentage of 80 % for future tense and for past tense. The average pretherapy percentage for comprehension and expression of present tense markers was 10% and 0 %, whereas the average post-therapy percentage for the same were 60% and 50 %, respectively. Thus this case study adds to the literature that augmenting verbal output with gestures will foster the comprehension and expression of language abilities. This study also reveals that AAC can be used for individuals who belong to expressive and/or supportive language groups, and thus works towards eliminating the misconception of AAC being reserved for individuals with severe disabilities.

Keywords: Gestures, Augmentation, Tense markers, Communication, AAC

1. Introduction

The primary aim of Augmentative and Alternative Communication (AAC) is to facilitate a child's communicative competence through the use of multiple communication modalities that either supplement ("augmentative") or replace ("alternative") natural speech (Light et al., 2003). AAC involves aided systems, including picture symbols, miniature objects, real objects, written words, or speech-generating devices, as well as unaided systems including gestures, body language, and sign language (Loncke, 2022). Von Tetzchner & Martinsen (1992) classified individuals who could benefit from AAC into three groups: (1) those who can understand spoken language but find it difficult to express themselves (expressive language group); (2) children who utilize AAC on temporary basis to enhance the understanding of spoken language and also to express themselves or children who speak but have difficulty being understood (supportive language group); and (3) those who use AAC as a long-term method for both receptive and expressive communication (alternative language group).

For individuals who belong to the alternative language group (Tetzchner & Martinsen, 1992), aided AAC systems are most frequently used because they provide alternative access methods such as, eye gaze or switch scanning, that accommodate fine motor impairments. These systems are also beneficial because they can be understood by non-trained listeners and often include visually represented symbols that resemble their referents, enhancing communicative clarity (Mirenda, 2001).A case study by Light et al. (2021), highlights the implementation of a personalized AAC intervention for a 3-year-old child with developmental delay and complex communication needs (CCN). Post 6 months intervention, the child showed substantial improvement in speech, language and literacy skills using gestures and signs; low tech photos, pictures, line drawings, written words, and letter cards; and mobile technology with an AAC app and keyboard. The child developed a wide range of semantic concepts and regularly used multi-word messages with increased use of grammatical structures (articles, conjunctions, etc). The child's speech became 95% intelligible to familiar adults, with notable improvements in vowel and consonant production. Also, her literacy skills surpassed those of typically developing peers. Sennott, Light, and McNaughton (2016) found that aided AAC modeling within naturalistic interactions led to meaningful gains in pragmatics, semantics,

syntax, and morphology. Findings from 17 studies using multiple-baseline or probe designs support high-tech AAC as an evidence-based practice for teaching social-communication skills to individuals with autism or intellectual disabilities, though it showed no clear advantage over low-tech AAC (Morin et al, 2018).

A multiple probe design was used in a study by Luckins et al. (2025) to assess Total Communication in three children aged 8–10 within a storytelling context. The intervention included speech, signing, VOCAs, and communication boards. All participants showed increased use of propositions and longer utterances across various communication modes. Studies emphasizing the importance of sign language and gestures that help facilitate verbal language are available, however, it has been tested less frequently in speech and language disorders. Also, the literature related to the impact of AAC in improving the communication abilities of children falling under the support language group is sparse (Daniels,1995; Jantzen, 2011).

Gestures are an unaided mode of communication utilizing spontaneous movements of hands and arms during a cognitive activity (Kita et al., 2017). It can indeed occur independently of speech (Goldin-Meadow, 2003). In typically developing children, gestures predict language development, increasing around 18 months and decreasing as verbal skills grow. Despite this decline, gestures remain in use among older children, adolescents, and adults (Capirci et al., 1996; Tellier, 2009; Özçalışkan & Goldin-Meadow, 2009; Trafton et al., 2006). Many studies also indicates that gesture serves as a significant facilitator in second language acquisition, as it aids in conveying meaning, compensating for speech limitations, and enhancing memory retention when compared to purely verbal instruction (Cao & Chen, 2017). Co-speech gestures are spontaneous hand motions that naturally follow all spoken words. They are generated in time with speech (Clough & Duff, 2020). It is used to enhance thinking and reasoning and to clarify speech expression of thoughts (Matsumoto & Hwang, 2013). Hostetter's (2011) meta-analysis demonstrated that observing gestures alongside speech significantly enhances comprehension compared to situations where no gestures are present. Many authors follow McNeill's (1992) theoretical framework, which identifies four types of gestures: (1) Iconic gestures, which visually represent the meaning of spoken words (e.g., saying "I turned the shape" while showing the rotation with a hand movement); (2) Metaphorical gestures, which resemble iconic gestures but convey abstract ideas (e.g., saying "it's the same" while extending both hands to suggest equivalence); (3) Deictic or pointing gestures, which indicate specific objects or directions, either concrete or abstract (e.g., saying "I went there" while pointing); and (4) Beats, which are rhythmic hand movements that emphasize speech without carrying specific meaning (e.g., subtle hand motions to stress certain words). A study by Lacombe et al. (2022) reports that children with intellectual disability (ID) use iconic gestures significantly more than their peers matched according to their mental age (MA), chronological age (CA) or language age (LA).

Children with ID exhibit significant difficulties in higher-order language skills involving thinking and reasoning (INSER, 2016) and difficulty in

developing rule-oriented language behavior (Abbedutto & Chapman, 2005). Hence, the usage of tense markers is found to be significantly reduced in them compared to typically developing children (Kaur, 2017). In addition, to support their reasoning and thinking skills, individuals with intellectual disability make frequent use of co-speech gestures compared to the typically developing population (Stefanini et al., 2007, 2008; Lacombe et al., 2022). Hence, this ability might have the potential to be utilised as an augmentative communication to enhance language skills such as tense markers in children with intellectual disability. Utilising the whole range of verbal language and gestures in these children facilitates more effective communication (Wagner et al., 2014).

Tense markers serve as a key syntactic tool for indicating temporal relationships. It is expressed by altering verb forms to indicate whether an action happens in the past, present, or future. Basic tenses such as past, present and future are found in many languages. According to Browns stages of language development, development of tenses begins in stage 2 and continues well in the school age years. The period of greatest acquisition is from 4 to 7 years (Brown, 1973).

Spoken in Karnataka, as well as in Andhra Pradesh, Tamil Nadu, Kerala, Maharashtra, Goa, and other parts of India, Kannada is one of the major Dravidian languages.The official designation of Kannada as a "Classical language" by the Union Government of India implies that it has been used for more than 1600 years. Kannada is a mora-timed language indicating the rythm produced by the native speakers of this language is dependent on individual morae(a unit of timing) rather than stress or syllable (Savithri, Goswami, & Kedarnath, 2007).The majority of people in urban and suburban areas use borrowed words and phrases in the spoken variety, indicating that Kannada in its current form has been somewhat influenced by English and neighbouring languages (Bhat, 2012).But there is a significant preservation of the syntactic structure of the language. There are limited studies on acquisition of tense markers in typically developing Kannada speaking children. A study by Srihari et al. (2022) found that Kannada-speaking typically developing children begin to use tense markers between the ages of 5 and 6. This development continues until age 7, with mastery generally achieved by age 8. Subbarao (1995), reported that the use of present tense markers was most prevalent among typically developing children aged 4 to 6. He also concluded that the performance of children with Intellectual disability was lower compared to the mental age matched typically developing peers with respect to the syntactic aspects of language including tense markers. Shasthry (2010) conducted a study on how 5- to 8-year-old children who speak Kundapura Kannada acquire tense markers. It was found that present tense markers appeared more frequently than other tense forms. Interestingly, some dialectal variations in how these present tense forms were used were documented. Significant simplifications of consonant-vowel combinations were observed, along with instances of vowel shortening, syntactic deviations, and semantic deviations. In the study by Chaitra et al.(2021) done on typically developing Kannada speaking children of age range 5-8 years, it has been reported that the usage of simple present tense markers were found to be higher than that of simple future and simple

past tense.In a study by Nisha and Shetty (2023) on 8-12 years old typically developing Malayalam- English speaking bilingual children, it was concluded that children acquire simple present tense first followed by simple past and simple future tense in both Malayalam and English languages.

In sum, there is limited literature on the usage of gestures as an augmentation in enhancing the linguistic abilities of children with language difficulties. In addition, intervention studies specifically addressing the usage of tense markers in the Indian scenario, including Kannada language, are severely limited. All the above literature review necessitates conducting a preliminary study on using unaided augmentative communication for children falling under the support language group. Hence, the current study aims to explore the efficacy of unaided gestural augmentation in facilitating language skills, specifically tense markers in a Kannada-speaking verbal child diagnosed with Borderline Intellectual Functioning.

2. Methodology

The following methodology was used to investigate the use of unaided gestural augmentation to enhance the comprehension and expression of tense markers in a verbal child with borderline intellectual functioning. The participant of this study was a Kannada-speaking male child aged 10 years 7 months diagnosed with Spoken Language Disorder secondary to Borderline Intellectual Functioning. The child was not under any other medical or behavioural intervention. Convenient purposive sampling was used to select a case with the following inclusionary criteria. The usage of respective gestures was the independent variable and the outcome measure of the percentage of consistency for comprehension and expression of tense markers served as the dependent variable.

Inclusionary Criteria:

(1) The child should be utilizing verbal mode of communication
(2) The level of IQ should be not less than that of Borderline Intellectual Functioning.

All required ethical approval was taken from the author's institute's ethical committee to carry out the study. However, kindly note that the committee does not provide any reference number for the same. The study followed the Ethical Guidelines for Biobehavioural Research: Involving Human Subjects (Basavaraj & Venkatesan, 2009). The parent of the participant was explained in detail regarding the procedures in the study and written informed consent was taken

1.1. Data collection and processing

1.1.1. Setting

The data were collected in a clinical therapy setting at the All India Institute of Speech and Hearing (AIISH), Mysuru, Karnataka, India, where the participant was receiving speech-language intervention. AIISH functions as a center for clinical services, research, and academics.

1.1.2. Materials

Assessment Checklist for Speech-Language Skills (ACSLS) (Swapna et al., 2015) was administered to the participant. It is a standardized checklist assessing the receptive and expressive language skills of children in the age range 0 to 6 years. The checklist has been developed and standardized on Indian typically developing children and has good reliability and validity.

This checklist is explicitly developed for preschoolers with communication disorders up to 6 years of age .But it could also be utilized with an older child with communication problem who shows delay in various linguistic domains, a e.g child whose actual age is 9 years and developmental age is 5 years. This test material has almost all linguistic components in the order of their acquisition and their use in daily conversations, with tense markers also being one among them. Each of these linguistic components are assessed as whether achieved or emerging or not achieved based on direct interaction with the child as well as based on the parental report of the same. Since working on the comprehension and expression of tense markers was the main objective of this study and since the subject of the study was a native of India, ACSLS, an Indian standardized tool which constitutes tense markers as one of the components of evaluation was utilized to evaluate the receptive and expressive language skills of the child.

1.1.3. Research design

The study utilizes a pre-post comparison design within a single case study framework. The rationale for choosing this design was its effectiveness in exploring individual development within specific contexts. It is particularly useful for studying complex phenomena through detailed observations and rich narratives focused on a single individual or relationship (Råbu & Binder, 2024).

1.1.4. Procedure

The participant was attending speech-language intervention for a duration of 3 months on a weekly twice basis (on all Tuesdays and Thursdays). Each session of speech language intervention spanned 45 mins. The study was conducted in the following way. Assessment Checklist for Speech-Language Skills (Swapna et al., 2015) was administered to the participant based on which receptive language age and expressive language age were found to be 4.1 - 4.6 years and 2.7 - 2.9 years respectively. Psychological evaluation was done by a certified Psychologist in the institute who is not a part of the research team. Weschlers Intelligence scale was utilized for the evaluation. The mental age was found to be 5.8 years and the Intelligence quotient of the child was 72. According to International Classification of Diseases 11th Revision (ICD-11), the child was diagnosed as Developmental Language Disorder with Impairment of expressive language (6A01.21),Borderline Intellectual Functioning (MB21.Y).

1.1.4.1. Pre-intervention assessment

After the administration of ACSLS and psychological assessment, speech and language intervention was initiated. The first author of this

study was the interventionist as well as the one who did the speech language assessment including ACSLS.One of the language goals taken up was to improve the tense markers (simple past tense, present continuous tense, and simple future tense).The baseline evaluation of his comprehension and expression of tense markers for the verbs known to him was done during the 1st session. The participant had comprehension and expression of Kannada verbs like /hatʃu/, and /bari/ (paste, write) and English borrowed verbs like cut, wash, open, and close but exhibited significant difficulty in expressing them using tense markers in all the three tenses.The child was not at all using any tense markers in the daily conversations. He was only using the respective verb in the sentences. For example, in Kannada to indicate "I am cutting", the verbal expression is / na:nu cut ma:ḍṯaiḍini/. However the child was expressing only /na:nu cut/ which means "I cut". In other words, instead of Subject+Verb+Tense marker (which is the standard order of sentence in Kannada language), the child was only using Subject+Verb. The baseline indicated 10-20 % comprehension of basic tense markers (simple past, simple present and simple future tense) and 0 % expression of the same. These observations are based on the direct interaction with the child and from the parental interview.

These tense markers were considered as they are reported to be easier for young children compared to other tense markers and these were the tense markers used in most of the studies done on acquisition of tense markers in Indian children (Chaithra et al., 2021; Nisha & Shetty, 2023). Hence, to improve the usage of morphological structures for future tense, present continuous tense, and past tense (/ -- ona/, /-- iḍini/, /--ajṯu/) for the known six verbs, picture cards depicting the target verbs were used as stimuli.

1.1.5. Data collection

1.1.5.1. Intervention

In the initial 3 sessions, the speech-language pathologist (first author) presented the instructions for the comprehension of tenses in auditory verbal mode only. However, the participant exhibited difficulty in understanding the concept of tenses through this mode solely. Hence, from the fourth session, the gestural mode was introduced as an augmentation along with the auditory verbal mode for improving the comprehension of tense markers by the speech-language pathologist (first author). Later, gestures were also used as a prompt in achieving the goal. The gestures employed were conventionalized gestures used in India to represent present, past and future. The participant's improvement was monitored during the intervention based on his responses during the session. As the participant improved in comprehension, gestures were also used as an augmentation and as a prompt in improving the expression of tense markers as well. In Kannada, the tense marker is added after the verb. Here the gesture was presented soon after the production of the verb to augment the verbal production of the respective tense markers. The presentation of the same is depicted in Figure 2.

With the improvement seen in comprehension and expression of tense markers, the gestures used as an augmented mode faded. After the

introduction of gestures, 4-5 sessions were required to attain the goal. In each session, five trials were given for each of the tense markers for the selected verbs. The response for the comprehension of each of the target tense markers was considered consistent if the participant was able to comprehend tense markers independently in the evoked trials in three consecutive sessions. The same criterion was followed for the expression of tense markers as well. In total, 8 sessions were taken to teach the comprehension and expression of tenses. The documentation of the responses was done during the session itself by the speech language pathologist (primary researcher) administering the treatment. This documentation was done by calculating the consistency of response in terms of percentage and this served as the dependent variable. This percentage was obtained by dividing the number of trials in which the child comprehended the tense markers correctly by the total number of trials the therapist provided (5 trials) to elicit the comprehension of tense markers for each of the 6 verbs in the session where the baseline was also obtained (first session). The same measure was obtained in the 8th session as well. Similarly, the consistency was calculated for the expression of tense markers in the first and eighth sessions by dividing the number of trials in which the child expressed the case marker correctly by the total number of trials (5 trials) provided to the child for eliciting the expression of tense markers for each of the six verbs. These consistencies are tabulated in Table 1. The trials for each verb was presented in a randomised manner so as to reduce the effect of the order of trials as a confounding variable in the consistency of results. These trials involved the child being exposed to the gesture of each tense marker of each verb five times. The mother was guided to provide home training by providing more opportunities for the child to express the trained tense markers in naturalistic situations at home (such as when the child was involved in any craft activities involving cutting, pasting gum, writing , or in daily activities such as washing hands, opening and closing tap and so on).Also, verbal feedback was taken from the caregiver regarding the child's usage of tense markers at home. The respective gestures used to augment the comprehension and expression of past, present continuous and future tense markers are shown in figure 1.



Figure 1. Gestures used for augmenting comprehension and expression of (a) past tense (b) present continuous tense and (c) future tense markers.

The arrow indicates the direction of the hand movement during the gesture.

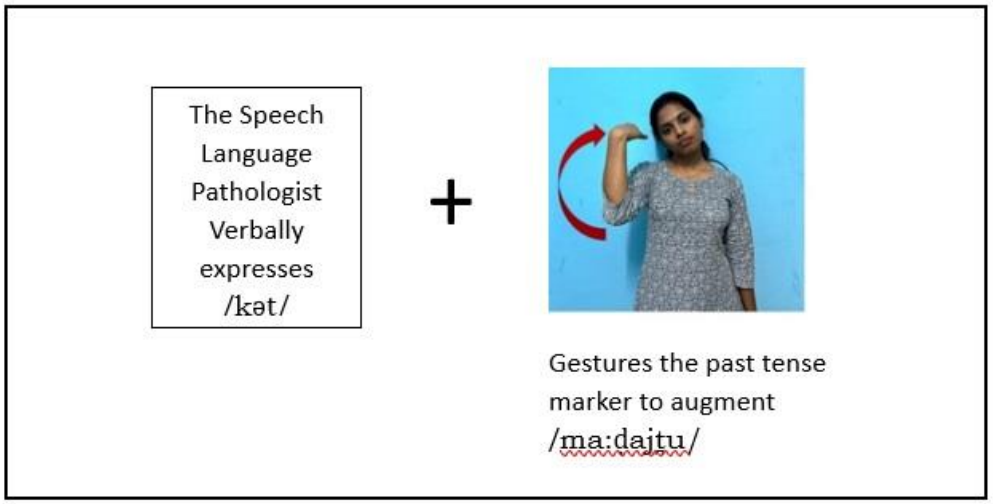


Figure 2 The presentation of gesture to augment the comprehension and expression of the past tense marker of Cut: /kəṭ ma:ḍajʈu/

1.2. Data analysis

The number of correct responses out of the five trials provided during each session and the number of sessions required to bring a change in response before and after the introduction of gestures served as the dependent variables. Each correct response was given a score of '1' and an incorrect response a score of '0'. The percentage of correct responses across the sessions was calculated and tabulated.

3. Findings

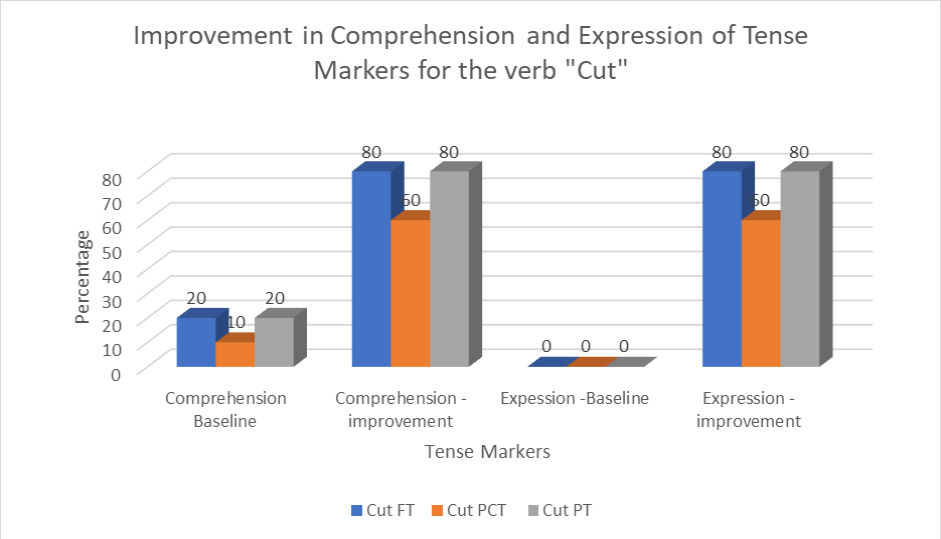
3.1. Post intervention assessment

A notable improvement was observed in terms of comprehension and expression of tense markers within four sessions of introducing gestures as an augmentative mode. Table 1 shows the comparison of the comprehension and expression abilities of the participant in tense markers before and after the usage of gestures as an augmentative communication mode.

Figures 3 to 8 illustrates the improvement in comprehension and expression of the Tense Markers for the verbs. From the Figures 1 it can be understood that the baseline comprehension of the Tense Marker for the verb "Cut" was 20 % for both Simple future and Simple Past Tense. The comprehension for the Present Continuous Tense of the verb "Cut"at the baseline was found to be 10 %. Post intervention, both the comprehension and expression of Simple future Tense of this verb was observed to be improved to 80% consistency. The comprehension of Present Continuous Tense improved to 60 %, the expression of the same also improved to 60 %. For the past tense marker, the improvement was found to be 80% % for both comprehension and expression. The graphs for other verbs can also be interpreted in similar manner.

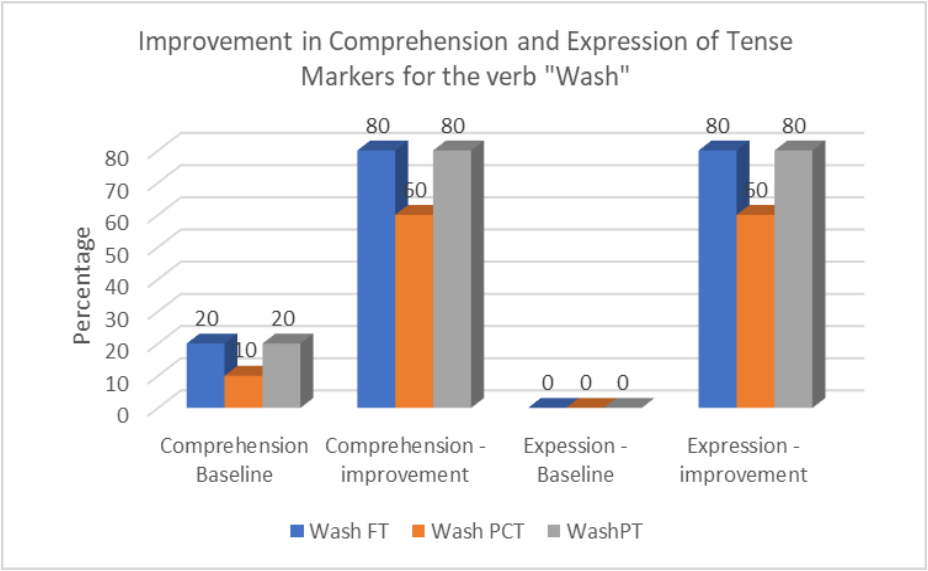
The child was not at all expressing any of the tense markers of these verbs in the baseline evaluation. Hence the consistency of expression of all

the tense markers at the baseline was marked as 0%. After providing language intervention augmented with the respective gestures, there was a remarkable improvement noted in both comprehension and expression of all the three tense markers.



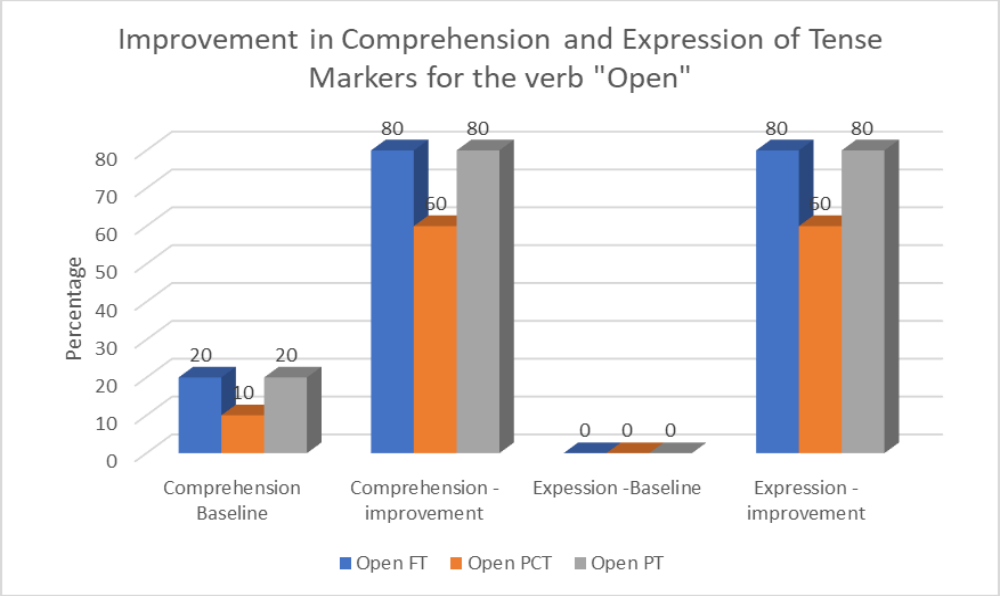
Note: FT- Future tense; PCT- Present continuous tense; PT- Present tense

Figure 3 Improvement in comprehension and expression of Tense Markers for the verb " Cut"



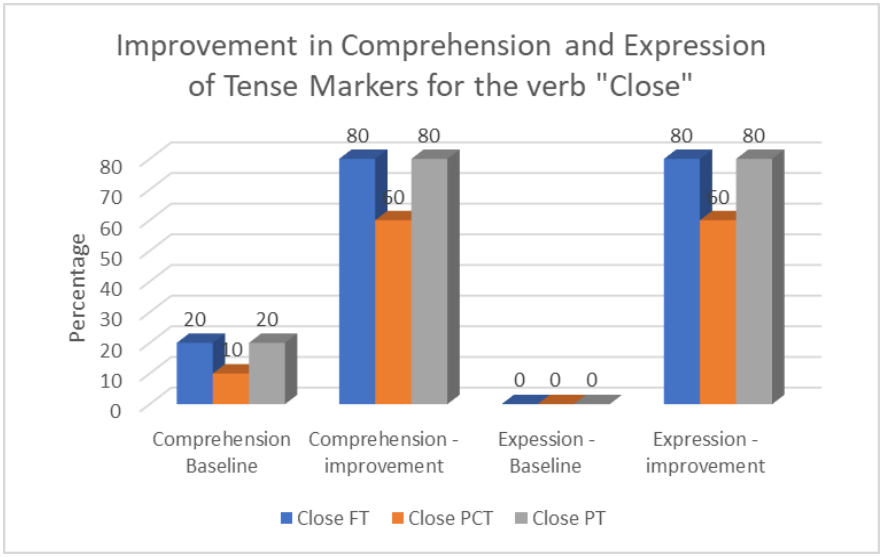
Note: FT- Future tense; PCT- Present continuous tense; PT- Present tense

Figure 4 Improvement in comprehension and expression of Tense Markers for the verb " Wash"



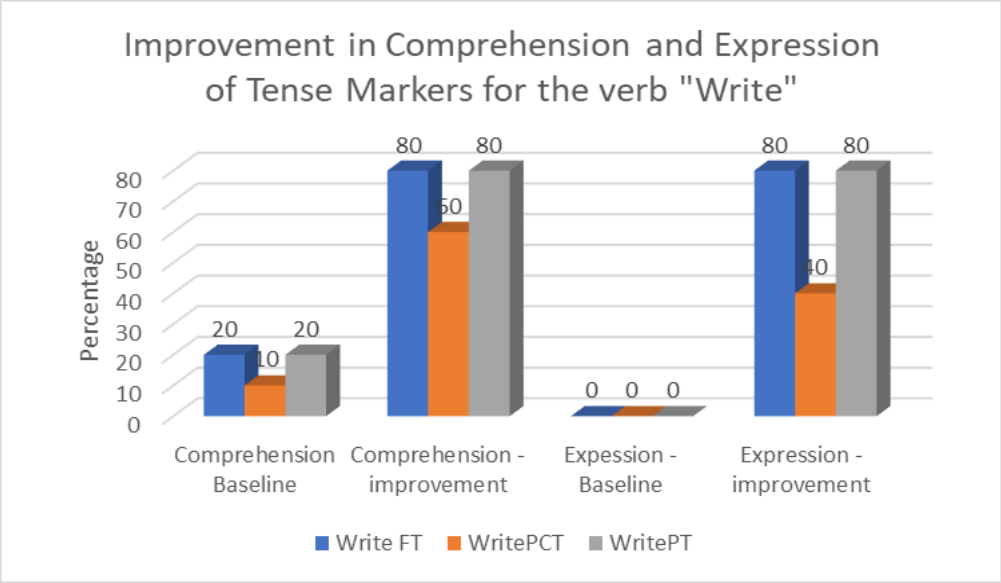
Note: FT- Future tense; PCT- Present continuous tense; PT- Present tense

Figure 5 Improvement in comprehension and expression of Tense Markers for the verb " Open"



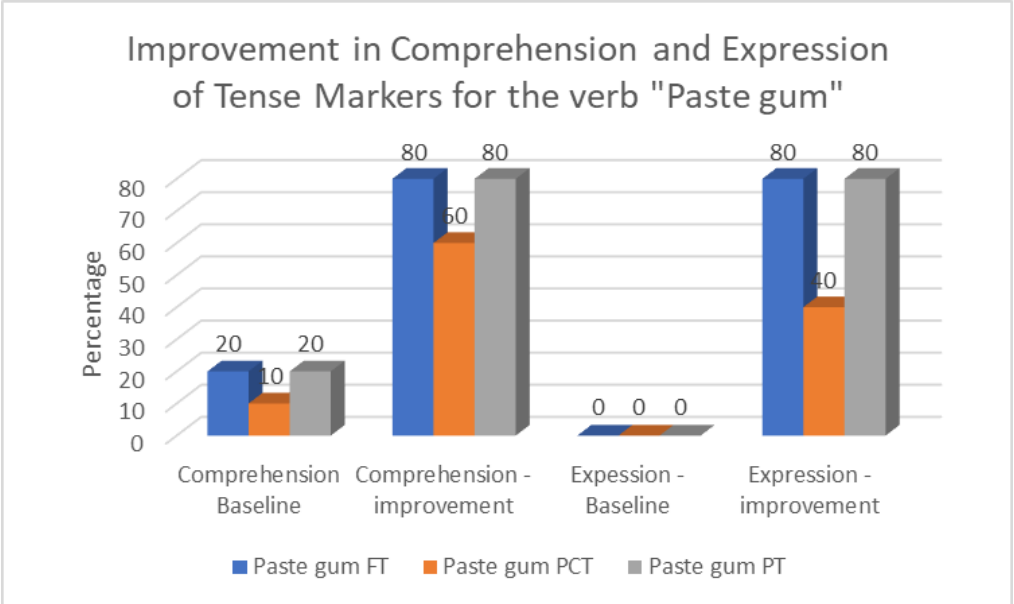
Note: FT- Future tense; PCT- Present continuous tense; PT- Present tense

Figure 6 Improvement in comprehension and expression of Tense Markers for the verb " Close"



Note: FT- Future tense; PCT- Present continuous tense; PT- Present tense

Figure 7 Improvement in comprehension and expression of Tense Markers for the verb “Write”



Note: FT- Future tense; PCT- Present continuous tense; PT- Present tense

Figure 8 Improvement in comprehension and expression of Tense Markers for the verb “Paste gum”

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Table 1
The baseline and the improvement in comprehension and expression of tense markers

Target	English Translation	Tense	Comprehension – Baseline (%)	Comprehension – improvement after using gestures (%)	Expression- Baseline (%)	Expression – Improvement after using gestures (%)	No of sessions required after the introduction of gestures
/kəṭ **ma:dona**/	Shall cut	Future tense	20%	80%	0%	80%	4
/kəṭ **ma:ḍṯaiḍini**/	I am cutting	Present continuous tense	10%	60%	0%	60%	5
/kəṭ **ma:ḍajṯu**/	Have cut	Past tense	20%	80%	0%	80%	4
/va:ʃ **ma:dona**/	Let's wash	Future tense	20%	80%	0%	80%	4
/va:ʃ **ma:ḍṯaiḍini**/	I am washing	Present continuous tense	10%	60%	0%	60%	5
/ va:ʃ **ma:ḍajṯu**/	Have washed	Past tense	20%	80%	0%	80%	4
/opəṇ **ma:dona**/	Let's open	Future tense	20%	80%	0%	80%	4
/ opəṇ **ma:ḍṯaiḍini**/	I am opening	Present continuous tense	10%	60%	0%	60%	5
/ opəṇ **ma:ḍajṯu**/	Have opened	Past tense	20%	80%	0%	80%	4
/klos **ma:dona**/	Let's close	Future tense	20%	80%	0%	80%	4
/klos **ma:ḍṯaiḍini**/	I am closing	Present continuous tense	10%	60%	0%	60%	5

/ klos **ma:ḍajʈu**/	Have closed	Past tense	20%	80%	0%	80%	4
/bari**jona**/	Let's write	Future tense	20 %	80%	0%	80%	4
/bari**ʈaiḍini**/	I am writing	Present continuous tense	10 %	60%	0%	40%	5
/bar**da:jʈu**/	Wrote	Past tense	20 %	80%	0 %	80%	4
/gum **hatʃona**/	Let's put gum	Future tense	20 %	80%	0%	80%	4
/gum **hatʃʈaiḍini**/	I am putting gum	Present continuous tense	10 %	60%	0%	40%	5
/gum **hatʃa:jʈu**/	Have put gum	Past tense	20 %	80%	0 %	80%	4

4. Discussion

From the results, it can be inferred that there was an acceleration in the comprehension and expression of tense markers after the introduction of the gestural mode along with the verbal modality. This is in consensus with the previous studies which indicate the fact that unaided AAC interventions appear to facilitate the development of speech (Millar et al., 2006). In addition, the participant had cognitive skills sufficient to understand the simple gestures and was motivated to attend speech language intervention sessions (this is based on the researcher's observation of the child's responses during the intervention sessions). In terms of home training, the mother was also facilitative in providing adequate support to the child. Verbal feedback was taken regularly from the mother regarding the performance of child at home and the speech language pathologist provided suggestions regularly so as to elevate the quantity and quality of home training. The child's adequate comprehension skills enabled him to understand the co-speech gestures used by the speech-language pathologist, which may have further reinforced their meaning.

There is a dearth of literature addressing the language intervention specifically for tense markers in Indian languages including Kannada. However, there are a couple of studies done in English language regarding language intervention improving the usage of tense markers in children diagnosed with various language disorders. In a study by Calder et al.(2021), an improvement was observed in the usage of past-tense markers in children of age range 5.9 years of 6.9 years , diagnosed with Developmental Language Disorder (DLD), on using visual cues to train the expression of the same. The visual cues involved the representation of morphological features using colours, shapes and arrows where colour coding was used to symbolise the parts of speech. Owen Van Horne et al. (2017) assessed a largely implicit intervention that targeted regular past tense production over the course of up to 36 intervention sessions in a randomized controlled trial (RCT) including 18 children ages 4 to 10. The children in the past tense verb condition made larger improvements on untrained verbs with a large effect. The results showed that learning more complicated past tense verbs had benefits. The effectiveness of enhanced recasting in enhancing regular past tense for 20 children with DLD, ages 4.8 to 6.7 years , was investigated by Eidsvag et al. (2019). Children were delivered therapy once a day for five days throughout five weeks, either individual or as group therapy. The mean improvement on past tense morphemes for both delivery situations was found to be significant. These studies did not employ the usage of gestures as an independent variable to bring about a change in the usage of tense markers. In the current study, an improvement in the usage of all three tense markers was brought in the child through the use of gestures, thereby demystifying the potential of gestures in facilitating and augmenting the comprehension and expression of tense markers.

It can also be deduced from the Figure 1 to Figure 6 that the consistency of the tense marker of the present continuous tense was lower than the future and past tense for all target verbs. The following reasons might have contributed towards the lower consistency. One of the reasons might be the relative lack of iconicity in the present tense gesture as

compared to the past and future tenses. Whereas the past tense clearly denotes 'back', and the future clearly denotes 'forward', the present tense gesture is more opaque. An equally iconic gesture, can be explored in the future studies. Also in the current study, we analyse this lower consistency with respect to the syllable structure of the respective tense morphemes. In Kannada, the simple past tense is marked by adding the morpheme "aitu"(VVCV) (C stands for consonant and V stands for Vowel), present continuous tense can be marked by adding the morpheme "taidini" (CVVCVCV) and simple future tense is marked by adding the morpheme "ona"(VCV) .Thus the syllable structure for present continuous tense is more complex than the tense marker for simple present and simple past tense in Kannada language. For example, for the root word /bari/ (write), the past-tense form is /bardaitu/(wrote), present continuous tense is /baritaidini/(writing) and future tense is /bariyona/ (will write) with CVCCVVCV, CVCVCVVCVCV and CVCVCVCV syllable structures respectively. This demonstrated a longer and more complex syllable structure for the present continuous tense, hence making it relatively difficult for the child to produce a present continuous tense marker. The studies by Subbarao (1995); Shasthry (2010); Chaitra et al. (2021); Nisha and Shetty (2023) have employed simple present tense and not present continuous tense. The present continuous tense in Kannada has more complex syllable shape than the simple present tense. This might be the reason the consistency of the present continuous tense marker was lower than the other tense markers in the current study unlike the other studies. However further studies are required to validate and establish this comparison.

Case studies are still highly popular among researchers in spite of the existing difference in opinion about the reliability and drawbacks of case studies, particularly regarding generalization, reproducibility, and bias from the researcher side (Thomas, 2011; Hyett, Kenny, & Dickson-Swift, 2014).This was a case study with one participant. Hence, the results need to be validated by conducting the study with a higher sample size. There are few other limitations for this study as well. Notably, it did not include a follow up assessment, which limits the ability to evaluate whether the improvements were sustained over time. Also, in the current study the data was documented only with respect to the overall performance in the trials given and the variation of performance in consecutive trails were not considered. In future studies, more detailed documentation can be incorporated where, specifically, for each verb form, it can be reported if three or more successive trials were 'correct' or not as well as where the trials fall within the 5 total. The current study did not employ a detailed qualitative analysis. The quantitative analysis of responses can be accompanied by qualitative analysis also to strengthen the future case studies. This may help to understand how learning occurred for each verb form, rather than for the tense overall. Also, the study can be extended to other higher-level linguistic goals. Further, it can be applied to children with various other communication disorders like autism, developmental language disorder, apraxia, and so on. These populations often experience challenges with morphosyntactic development and may face difficulties in acquiring and

generalizing grammatical structures (Moraleda-Sepúlveda & López-Resa, 2022; Reis & Teixeira, 2012).Further, this study is an example indicating that incorporating or augmenting even a simple conventional gestures in speech-language intervention session may expedite the process of learning in individuals with special needs.

5. Conclusion

The study indicates that the use of gestures as an augmentative aid does improve the comprehension and expression of higher-order language aspects. Also, this study aids in dispelling the myth that AAC is not only used for children with CCN, in fact, it can also be used for support language groups.

In sum, augmenting verbal output with gestures may foster the comprehension and expression of language abilities in children with intellectual disability. Further, there is no candidacy to use AAC and be implemented for those who are expressive in nature as well. This preliminary case study highlights initial findings that should be validated through further research with a larger sample size.

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