LINGUISTIC VARIABILITY IN MONO AND BILINGUAL CHILDREN WITH STUTTERING

Thesis submitted to the University of Mysuru

for the award of degree of

Doctor of Philosophy (Ph.D) in Speech and Hearing

By

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September, 2015

Certificate

This is to certify that this thesis entitled **''Linguistic Variability in Mono and Bilingual Children with Stuttering'**, submitted by Ms. Sangeetha Mahesh for the degree of doctor of Philosophy in Speech and Hearing to the University of Mysore, Mysore was carried out at All India Institute of Speech and Hearing, Mysore.

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Certificate

This is to certify that this thesis entitled **'Linguistic Variability in Mono and Bilingual Children with Stuttering',** submitted by Ms. Sangeetha Mahesh for the degree of doctor of Philosophy in Speech and Hearing, to the University of Mysore, Mysore is the result of the work done by her at All India Institute of Speech and Hearing, Mysore, under my guidance. I further declare that the results of this work have not been previously submitted for any degree.

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Declaration

I declare that the thesis entitled **‘‘Linguistic Variability in Mono and Bilingual Children with Stuttering’,** which is submitted herewith for the award of degree of doctor of Philosophy in Speech and Hearing at the University of Mysore, Mysore is the result of work carried out by me at All India Institute of Speech and Hearing, Mysore, under the guidance of Dr. Y. V. Geetha, Prof. in Speech Sciences, Department of Speech-Language Sciences, All India Institute of Speech and Hearing, Mysore- 570006. I further declare that the results of this work have not been previously submitted for any degree.

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ACKNOWLEDGEMENTS

My deepest gratitude is to my Guide, Dr. Y.V.Geetha, Prof. in Speech Sciences, who gave me the freedom to explore in my own way and at the same time, the guidance to recover when my steps faltered. You have been my source of inspiration, enabling me to pursue my doctoral work.

I would like to thank Prof. S. R. Savithri, Director, AIISH for the constant support, insightful comments, and constructive criticisms at different stages which helped me to achieve higher standards of research.

I respectfully acknowledge Late. Dr. Vijayalakshmi Basavaraj, Director, AIISH, who granted me permission to undertake this thesis and avail the facilities of the institute.

It is a pleasure to thank Dr. Nagarajan, Principal SRC ISH, Bangalore; Dr. Jayashree Bhatt, Principal, KMC Mangalore; Prof. Subbarao, Principal, Dr. M.V. Shetty College Mangalore; Principal, Fr. Muller College of Speech and Hearing, Mangalore; for helping me in data collection without whom this thesis would not have been possible.

I specially thank the members of Fluency Unit, Ms. Geetha M.P, Ms. Seema M., and Mr. Varun U., for providing me the details of participants for data collection.

I would like to thank Dr. Prema K.S., Prof. in Language Sciences, Ms. Leelarani, Special Educator; Ms. Vijayalakshmi (CIIL); Dr. Brajesh P., Ms. Ramya and Ms. Nidhi, Linguists - for their valuable suggestions with respect to linguistic analysis of the data.

I extend my thanks to Dr. Vasanthalakshmi for the assistance provided during the statistical analyses. You have enriched my knowledge in statistics and helped me understand the results of my research better. My sincere thanks are also due to Mr. Santhosh, for rendering statistical assistance in portions of my thesis.

I am grateful to Dr. Pushpavathi, Dr. S.P. Goswami, Dr. Sreedevi N., and Dr. K. Yeshoda for the support rendered during their tenures as HOD – Clinical Services.

I am also thankful to Dr. Shijith, Mr. Nanjundaswamy and the team at LIC for their invaluable assistance.

A million thanks to all the children and their families who co-operated patiently for my study.

I owe my thanks to Ms. Beena M., for her timely help, contributions, constant support and being a motivating factor during the process.

Dr. Sreedevi N. and Dr. Pushpavathi M. – "A friend in need is a friend indeed" – This statement is very much true with both of you. Thank you so much for all the help at various junctures towards the completion of this thesis. Thanks also to my dearest friends – Dr. Swapna and Dr. Jayashree S., for the constant encouragement which helped me sustain my motivation all the way through.

I express my gratitude to Dr. Deepa M.S., Mr. Gopi Sankar, Mrs. Priya M.B., Mrs. Prathima S., and Mrs. Preethi T., Mrs. Suchitra, Mrs. Sujatha and Mrs. Vijayshree – for their various forms of support and concern during my doctoral study.

I am grateful to Ms. Pankaja, Ms. Rekha, Ms. Akshatha and Mr. Sumanth, for their contributions at various phases of my research.

I am also indebted to Mr. Chethan and Mr. Gopi Sankar for the technical expertise rendered in formatting the thesis to its present state.

Most importantly, none of this would have been possible without the love and patience of my family. My dear Amma and Daddy, I owe this to you …… for the everlasting prayers, motivation, love, confidence and support you provided me. Amma – for being my centre of calm in the whirlwind of life!

My special thanks to dear husband, Mahesh and my little Roshan – for being my pillars of support, my greatest motivators, and for making this day possible!

I warmly appreciate the generosity and understanding of my in-laws, brothers, my sis Kavi, brother in-law Murugesh, and my muddu Kishan. Lets enjoy the Get-Together party – after years of toil and struggle!

Lord Almighty, my immense thanks for providing all these people in the process of completing my thesis and providing me with strength, motivation and courage all my life!

ABSTRACT OF THE THESIS

The interest in language and stuttering connection has been triggered by many observations by the researchers. The studies on stuttering in other languages are a requisite to confirm the results. Thus, it calls for further research in considering the enormous linguistic variability in 6 to 8 years age group in the bilingual and Indian context. The present study was planned with the main aim of a comprehensive evaluation of the patterns of disfluencies, language abilities and linguistic determinants in monolingual and bilingual children with stuttering. A total of 120 participants in the age range of 6-8 years comprising of 4 groups (2 clinical & 2 control groups; Monolingual & Bilingual) were considered in the present study. Phase 1 included the administration of questionnaire related to nature of stuttering and language use to both parent and child and elicitation of the speech samples across various tasks. Phase 2 included the administration of speech-language tests assessing degree of stuttering and language abilities. The results indicated that the disfluencies and degree of severity seem to present a similar trend in both groups of ML and BL CWS, and across languages. Both the groups demonstrated the full range of language abilities as poor, average, and superior. Mixed findings were noted in the language abilities sometimes favoring the ML, sometimes the BL, and sometimes both exhibiting a similar pattern. ML CWS with moderate stuttering performed better in language abilities than those with severe degree of stuttering, while the same was not noted in BL CWS. The results on linguistic influences on disfluencies revealed, greater occurrence of disfluent consonants than disfluent vowels; disfluent clusters than disfluent consonants; place and manner of articulation of most and least frequently disfluent consonants varied across groups; disfluent vowels showed a similar trend; greater occurrence of disfluencies on the initial phoneme positions than other positions; content words than function words; verb phrase than noun phrase; increased percentage of disfluencies with increased number of syllables in a word and words in a sentence. It was found that for few linguistic determinants variability existed supporting the viewpoint of “Variability as the hallmark of stuttering”. This cross-linguistic study revealed few common and differential characteristics relating to fundamental connections between stuttering and linguistic aspects of the languages.

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CHAPTER I

INTRODUCTION

"Stuttering" as defined by the World Health Organization (WHO, 1997) relates to "disorders in the rhythm of speech in which the individual knows precisely what he wishes to say but at the time is unable to say because of an involuntary repetition, prolongation or cessation of a sound". It is a speech disorder that has triggered enormous research over the decades by researchers from varied disciplines. Stuttering most often begins insidiously at some stage during the acquisition of speech and language. The incidence of stuttering is highest during the preschool years and onset is mostly between two to five years, which coincides with language learning period. The persistence of stuttering in young children beyond the age of 6 years confirms fluency problem and rules out possibility of children exhibiting normal non-fluencies.

Stuttering is a disorder of speech fluency covering a broad spectrum of severity that includes individuals with just perceptible impediments as well as others with particularly severe symptoms. The speech disfluencies are seen in all individuals, more so in the early developmental period in young children, and are referred to as Other Disfluencies (ODs) involving interjections, revisions, multisyllabic/phrase repetitions, which are typically seen mainly due to language formulation difficulties. The stuttering like disfluencies (SLDs), however, are reported to be different from ODs (Ambrose & Yairi, 1999) and are characterized by part-word repetitions, single-syllable repetitions, disrhythmic prolongations, blocks and broken words. The secondary behaviors, also referred to as physical concomitants, secondaries, non-speech behaviors or associated behaviors are not related to speech execution. It is reported to be learned coping behaviors which are associated with the presence of disfluencies and include various bodily movements like eye blinking, nose flaring, facial grimaces, jerky head or limb movements, and avoidance strategies such as avoiding specific words, people or speaking situations. There is greater level of inconsistency in the quality and quantity of disfluencies in persons with stuttering (PWS), both within and among individuals, depending on the speaking situations and the language related factors.

Researchers have described stuttering from several perspectives relating to onset, development and variability among people who stutter. Stuttering forms a heterogeneous group and hence there have been various explanations for stuttering throughout history. The theories of stuttering explain the intrinsic and extrinsic factors that influence one's ability to produce fluent speech (Andrews, Hoddinott, Craig, Howie, Feyer, & Neilson, 1983). Theories or models of stuttering can be classified into: 1) *psychological theories* which suggest that stuttering symptoms are related to psychological or emotional conflict; 2) *learning theories* propose that speaker learns that speaking is difficult and consequences of struggle begin; 3) *physiological theories* propose a breakdown in fluent speech, due to anatomical and physiological factors in the speech production system including genetic factors; and 4) *multifactorial theories* believe in combination of psychological and physiological factors that lead to initiation and maintenance of the course of stuttering. Some theories provide better explanations concerning onset of stuttering and others provide explanations of the subsequent development of the problem. The recent multi-factorial theories like the demands-capacities model highlight the dynamic nature of the language and linguistic capacities apart from others in the onset and development of stuttering.

One of the unique nature of stuttering relates to its occurrence across all languages and cultures. India is popularly known for usage of more than one language by people. Children attending school are exposed to at least two languages and the extent of exposure depends on the medium of instruction. The term "bilingualism" refers to "the total, simultaneous and alternating mastery of two languages' to 'some degree of knowledge of a second language in addition to spontaneous skills which any individual possesses in his/her first language" (Singuan & MacKay, 1987). The relationship between bilingualism and stuttering emerged to present inconsistent pattern. It has been speculated that a bilingual child will face language demands. Hence, the researchers have emphasized that the fluency should be assessed in the known languages of the child.

The relationship between stuttering and bilingualism can be termed as mysterious. The concerned issues include number and age of participants, set of languages known, age of acquisition of known languages, usage of both languages and the process involved in assessing stuttering as well as bilingualism. Au-Yeung, Howell, Davis, Charles, and Sackin (2000) used online assessment and found similar prevalence rates of stuttering in bilingual and monolingual speakers. Nwokah (1988) proposed three assumptions to describe stuttering in bilinguals. These assumptions are that stuttering appear in one language but not in other language, that stuttering appear in both known languages to the similar extent (the same hypothesis) and that stuttering appears in both languages to dissimilar extents (the difference hypothesis). Majority of the researchers have noted that the distribution of stuttering may or may not be identical across languages the individuals with stuttering speak, supporting the second and the third hypothesis (Howell, Au-Yeung, & Sackin, 1999).

The interest in language and stuttering connection has been triggered by many observations by the researchers. Some of these include the typical onset of stuttering during the critical language development period, presence of delayed speech and language and phonological problems in more than one third of children with stuttering (CWS) and the disproportionate occurrence of the moments of stuttering at typical linguistic contexts more than the chance occurrences. Linguistic aspects of stuttering form an important discipline and have presented a long research history. The question of whether CWS diverge from children who do not stutter (CWNS) with respect to linguistic capabilities has been a much investigated subject since the early 1990's (Ryan, 1992; St. Louis & Hinzman, 1988). In particular, few investigators have found poorer language skills in young CWS than normal peers.

Bernstein Ratner and Silverman (2000) suggested disproportion amongst the speech-language components in young CWS. These differences may disrupt the continuous flow of speech which results in corrections. The repairs or corrections are noticeable explicitly as some type of disfluencies (Anderson & Conture, 2000). Few researchers have noted that CWS as a group performed similar to CWNS while still others (Reilly, Onslow, Packman, Wake, Bavin, Prior, et al., 2009) have stated that CWS might have advanced language abilities. Hence, the findings from empirical research on CWS have been less than consistent. The mixed results suggest nonexistence of universal phenomenon and no traits are common to all CWS.

From the early works of Brown (1938, 1945), linguistic studies have investigated the loci and frequency of stuttered events related to the phonetic, lexical, syntactic and pragmatic components of language. From a phonetic point of view researches were focused on underlining the frequency of the speech difficulties in comparison with the phonemes uttered. The position of the instance of stuttering was definitely present in initial position. The most frequently used and the most familiar words were least difficult for a person with fluency disorder. The frequency in producing words function on the same level with phonological coding, aspect which can explain the difficulties specific for stuttering pathology when syntactically complex linguistic structures are handled (Bock & Levelt, 1994). Few researchers concluded that the grammatical development can be a predicting factor for stuttering pathology (Watson, Byrd, & Carlo, 2011). The relation between linguistic complexity and the loci of stuttering, in the case of a linguistic structure was established through a series of researches (Siegel, 1998). Stuttering episodes seem more likely to appear at the level of the first parts of a sentence, in nominal (Bernstein Ratner, 1981) and verbal clauses (Bock & Levelt, 1994).

Studies regarding phonetic determinants of stuttering indicated that CWS had more disfluencies on words that began with late emerging consonants than on consonants acquired during the beginning period. The consonants ending words were more disfluent compared to vowels, which were confirmed by Dworzynski and Howell (2004) in PWS in German language. Similar findings were noted even in children above six years. However, according to Howell and Au-Yeung (2007), a few studies did not observe similar effect. The finding of various studies conforms to the presence of phonetic determinants of stuttering, though certain differences exist.

Stuttering is mostly observed in the initial position at word level. Such occurrences relate to the theory "anticipatory priming". It suggests activation of related nodes for error-free output. The first activating node simultaneously primes further nodes in a word and the priming of last node constitutes "anticipatory priming". Stromsta (1986) found that deficits in anticipatory coarticulation may be the probable cause for the presence of core behaviours in stuttering. A number of brain structural and functional anomalies have been evidenced in CWS (Chang, Erickson, Ambrose, Hasegawa-Johnson,

& Ludlow, 2008; Watkins, Smith, Davis, & Howell, 2008). Asynchronies have been evident in speech muscles of PWS, not only during the moments of stuttering but also while speaking fluently. These findings illustrate that the temporal coordination of speech subsystems appear to be disturbed in PWS (Zimmerman, 1980).

An extensive research on phonetic determinants of stuttering revealed disco-ordination of phonation with articulation and respiration. Investigators have also described breakdown in phonetic transition in PWS. The likelihood of stuttering may enhance with involvement of speech muscles (Brenner, Perkins, & Soderberg, 1972). PWS have less refinement in articulation of individual speech segment due to “greater or quicker movement of the tongue body in transitioning from “closing to opening – to closing vocal tract gestures” (Robb & Blomgren, 1996). Postma and Kolk (1993) found that phone rates (phones per second) were generally slower for CWS than for CWNS. Their findings suggested that CWS exhibited either slower motor planning or longer central processing or both before execution. MacKay (1969a) hypothesized that breakdown within the speech muscles may not be the only reason for the occurrence of stuttering. Other factors like the tension and linguistic uncertainty can affect motor control and contribute to the occurrence of disfluencies.

Stuttering does not exist on each and every spoken word. The linguistic features of words may provide an understanding on the difficulty with words among PWS. Investigations have been conducted considering the lexical category (Brown, 1945; Howell, Au-Yeung & Sackin, 1999), phonological structure (Howell, Au-Yeung & Sackin, 2000), word frequency (Hubbard & Prins, 1994), and the word context (Yaruss, 1999; Logan, 2001). These investigations try to determine the relationship between linguistic variables and stuttering. Increased stuttering was observed on the first word of a sentence, less on the second word and even less on the third (Brown, 1945). Studies related to the occurrence of moments of stuttering have revealed that they are consistently in the beginning of the sentence. In addition, similar effect was evident for normal disfluencies (e.g., Holmes, 1988; Maclay & Osgood, 1959). The reason put forth relates to uncertainty connected with sentence planning, such as integrating syntactic constituents (Wall, Starkweather, & Cairns, 1981) or motor initiation/execution (Logan & LaSalle, 1999).

Researchers speculated a specific set of word class to be stuttered more often compared to others, across age groups. As established by Brown (1945), specific words that are mostly disfluent in PWS include content words, long words, words in initial positions and words that begin with a consonant. In contrast to his finding on adults, Bloodstein and Grossman (1981) found that CWS had more disfluencies on function words compared to content words. Increased length and complexity have been also contributing to greater demands and PWS are more susceptible to such demands (Bosshardt, 2006). The disfluencies may arise from problems in syntactic, phonological, or suprasegmental encoding (Bernstein Ratner, 1997; Postma & Kolk, 1993). The word related factors, like the word class, lexical stress, frequency and phonological structure are linked to each other. In addition, results from Zackheim and Conture's study (2003) suggest that difficulty with fluency is not only linked to word features but is also related to mean length of utterance (MLU).

In general, stuttering forms a heterogeneous group of fluency disorders. From the linguistic perspective it has been studied with respect to various language and phonological delays or deficits and linguistic specific features of the moments of stuttering. Bilingualism and stuttering is an emerging area which provides a vast scope to study the language and stuttering connection. The linguistic aspects of stuttering form a significant discipline and have presented a long research history. In particular, few studies have found that various language skills of young CWS are reduced than CWNS, whereas others observed absence of such differences in CWS as a group, while still others have stated that CWS might have advanced language abilities. The mixed results suggest nonexistence of universal phenomenon and no traits are common to all CWS. Linguistic studies have also investigated the loci and frequency of stuttered events related to the phonetic, lexical, syntactic and pragmatic components of language. Some consistent findings relate to initial position, first parts of a sentence, familiarity of words and linguistic structure. According to authors, the disfluencies may arise from difficulties in phonological, lexical, syntactic, or supra-segmental encoding. These linguistic determinants are correlated with each other thus making it difficult to establish the significant contribution of the individual factors.

Studies related to the phonetic determinants of stuttering lead to consistent findings with greater disfluencies for consonants than vowels. However, the rank order of difficulty with regard to the disfluent and succeeding phonemes is not consistent. Considering the literature on morphological determinants the review on occurrence of stuttering confirmed the effect of position of the word and its length in a sentence. Several studies examining the connection between the occurrence of stuttering and word class revealed inconclusive results.

1.1. Need for the study

India is known for its multilingual and multicultural rich environment and stuttering is a disorder which is highly influenced by the same. The children attending schools are forced to use more than two languages from the beginning, or at least after their third grade. The prevalence of stuttering accounts to 1% of the world's adult population and about 5% in children (Bloodstein, 1995). Studies on stuttering and bilingualism are limited, inconclusive and reveal mixed findings. Hence, it is essential to study the influence of bilingualism on stuttering with regards to the Indian context. It is increasingly essential for speech language pathologists (SLPs) to be equipped and trained to the unique challenges inherent while dealing with bilingual CWS as it has both diagnostic and therapeutic implications. The SLPs while dealing with bilingual CWS should understand how these children vary when exposed to the second and third languages in school environment. The amount of language input plays a significant role in understanding the acquisition of languages in both monolinguals and bilinguals. The amount of stuttering in each language within an individual varies and is affected by language use and demands. Due to the equivocal findings across studies, the influence of language use on disfluencies in bilingual speakers remains uncertain.

Stuttering is constrained by linguistic variables and most of the data available is on English speakers. The studies on stuttering in other languages (cross-linguistic) are a requisite to confirm the results. Kannada, one of the Dravidian languages spoken in the state of Karnataka, India, is a syllabic language and quite different from English. English and Kannada are inherently dissimilar in their language structure. The major components of linguistic structure exhibit few or no similarities in their forms. Kannada is a mora timed language, each consonant cluster is followed by vowel and no word ends with consonants. English, on the other hand, is one of the official languages of India and is phonemic in nature. English is a stress timed language where the prominent syllables recur at regular intervals. Hence, examining the instances of stuttering in the two languages with varied linguistic structures may throw more light on the language influences on stuttering.

Majority of the studies reported in the Western and Indian contexts are on adult bilinguals with stuttering. The speech language production of CWS differs from that of adults who stutter and hence cannot be simply extrapolated. Hence, a considerably enhanced understanding of the complex manifestation of stuttering among children is absolutely necessary. Till date the few investigations that have addressed stuttering in monolingual (Kannada) and bilingual (Kannada and English) children have considered only a few linguistic parameters. According to literature, the possibility of stuttering instances presented either an identical or different pattern of disfluencies, thus leading to mixed findings. Hence, it is important to study the linguistic influences in mono and bilingual groups of CWS in the two languages with respect to language abilities in the two languages as well as how the moments of stuttering vary across the two language contexts.

The linguistic repertoire acquired by children in 6-8 year old group is almost complete except for a few morphophonemic structures and vocabulary. Most of the studies on CWS have focused on the preschool period and it is interesting to know whether such variations persist in early childhood when the stuttering pattern is relatively more consistent and chronic. Furthermore, although consistent evidence has been obtained with respect to the occurrence of stuttering with varying word and sentence lengths, limited studies have examined this effect in the transitional period of 6 to 8 years, coinciding with spurts in language growth. Hence, such findings necessitate greater in depth analysis in this age group.

Thus, in this context it becomes increasingly relevant to talk about bilingualism, language abilities, linguistic determinants and its effect on stuttering. Till date, studies have not investigated both the language abilities and the various linguistic determinants in the mono and bilingual groups of CWS. Thus, it calls for further research in considering the enormous linguistic variability in this age group in the bilingual context.

1.2. Aim

The present study was hence planned with the main aim of a systematic and comprehensive evaluation of the patterns of disfluencies, language abilities and linguistic determinants in monolingual and bilingual children with stuttering.

1.3. Objectives

The specific objectives of the study are to:

1. study the type of disfluencies (stuttering like disfluencies and other disfluencies), severity of stuttering in mono and bilingual CWS
2. compare the language abilities in mono and bilingual CWS and CWNS for first and second language
3. compare the language abilities in mono and bilingual CWS across severity of stuttering
4. investigate the phonetic determinants including disfluent phonemes and phoneme position within and between mono and bilingual CWS
5. investigate the morphological determinants including word class and word length within and between mono and bilingual CWS
6. investigate the syntactic determinants including sentence length and sentence structure within and between mono and bilingual CWS

1.4. Statistical hypotheses

The following null hypotheses were formulated with regard to the above objectives of the study. It is hypothesized that:

1. Monolingual and bilingual CWS will not differ with regard to the type of disfluencies and severity of stuttering.
2. Monolingual and bilingual CWS and CWNS will not differ in their language abilities in first and second languages (Kannada and English).
3. Monolingual and bilingual CWS will not differ in their language abilities across severity of stuttering.
4. Monolingual and bilingual CWS will not differ with regard to the phonetic determinants including disfluent phonemes and phoneme position.
5. Monolingual and bilingual CWS will not differ with regard to the morphological determinants including word class and word length.
6. Monolingual and bilingual CWS will not differ with regard to the syntactic determinants including sentence length and sentence structure.

CHAPTER II

REVIEW OF LITERATURE

Stuttering has been existing since early decades in the human history and so have the definition and the etiology. The researchers have tried to solve the question on etiology of stuttering on the predisposing, precipitating and perpetuating factors. The exploration for etiology of stuttering has not been conclusive. Stuttering possibly is caused due to interaction of multifactorial factors.

2.1. Definition of stuttering

Stuttering is a highly perplexing disorder of speech fluency which is noted even in its definition or description. It has been defined from different perspectives such as etiology, characteristic symptoms and the like. The most accepted definition given by Wingate (1964) is the description of stuttering which runs to half a page.

Wingate (1964) proposed three-part standard and a comprehensive definition of stuttering. The first part denotes the core features of stuttering that have universal applicability while the second and third parts identify the accessory and associated features, respectively. According to Wingate, the term ‘Stuttering’ means, “(a) Disruption in the fluency of verbal expression, which is (b) characterized by involuntary audible (or) silent repetition (or) prolongations in the utterance of short speech elements, namely, sound syllables and words of one syllable. These disruptions (c) usually occur frequently (or) are marked in character and (d) are not readily controllable. Sometimes the disruptions are (e) accompanied by accessory activities involving the speech apparatus, related (or) unrelated body structures (or) stereotyped speech utterances. These activities give the appearance of being speech-related struggle. Also, these are not infrequently (f) indications (or) report of the presence of an emotional state, ranging from a general condition of excitement (or) ‘tension’ to more specific emotions of a negative nature such as fear, embarrassment, irritation, (or) the like. (g) The immediate source of stuttering is some in-coordination expressed in the peripheral speech mechanism; the ultimate cause is presently unknown and may be complex (or) compound”.

Van Riper (1982) defined “Stuttering as the deviation in the ongoing fluency of speech, an inability to maintain the connected rhythms of speech”. He also defined “Stuttering as a disruption of the simultaneous and successive programming of muscular movements required to produce a speech sound or its link to the next sound in a word. Anticipation of this programming difficulty can then cause struggle and avoidance reactions which are secondary, variable and learned”. In the year 1993, Cooper defined “Stuttering as a diagnostic label referring to a clinical syndrome characterized more frequently by abnormal and persistent disfluencies in speech accompanied by characteristic affective, behavioral and cognitive patterns”. More recently, Guitar (1998) defined “Stuttering as characterized by abnormally high frequency or duration of stoppages in the forward flow of speech including repetitions of sounds, syllables, or words, prolongations and blocks”. Researchers suggest stuttering to present a multidimensional phenomenon made of socio-cultural, psychological, physiological and genetic factors. The onset of stuttering in preschool children has revealed significantly smaller gender ratios of approximately 2:1 (Yairi & Ambrose, 2005). The male-to-female ratios are larger, approximating 4:1 or greater in older children and adults (Craig, Hancock, Tran, Craig, & Peters, 2002), indicating that the girls are considerably more likely to recover than boys during preschool years (Ambrose, Cox & Yairi, 1997). Another unique feature of stuttering is the fact that higher occurrence of stuttering is observed in males (Kent, 1983).

2.2. Epidemology of stuttering

In general the prevalence of stuttering has been reported as approximately 1% (Andrews, 1984) in UK and USA. Comparable prevalence percentages have been reported in several developed nations (Ward, 2006). Andrews (1984) found that the risk of developing stuttering drops by 50% after age 4, 75% after age 6 and is virtually nil by age 12. However, literature (eg., Safwat & Sheikhany, 2014) also advocates treating these reports with caution since information related to age of onset often may not be accurate as it is reported by parents or caregivers weeks or months after the reported onset. Also, the informants may not have observed the child’s earliest moments of stuttering or may have considered them to be normal hesitations. A positive family history has been found in majority of PWS. Ambrose, Yairi, and Cox (1993) found that almost 79% of young children had positive family history of stuttering. Kent (1983) discusses the fact that a higher occurrence of stuttering in males is one of the few consistencies of this enigmatic disorder. According to O'Connell and Kowal (2005) disfluencies are an inherent part of speech, and the ability to control disfluencies is an essential aspect of speech-language acquisition.

2.3. Theories of stuttering

Stuttering has frequently been considered as not just a riddle but a sophisticated multidimensional jigsaw puzzle. Stuttering appears very different depending on one's experience and perspective. It is also a personal, social and scientific problem that has not been stated completely (Van Riper, 1982). Stuttering is a complex disorder composed of multiple levels or factors. The cause/s of developmental stuttering continues to be a challenge for dedicated researches in fluency disorders.

Theories or Models focus on the intrinsic and extrinsic factors that influence one's ability to produce fluent speech (Andrews et al., 1983; Andrews & Neilson, 1981). Bloodstein and Bernstein Ratner (2008) classify theories basically into theories of etiology and moments of stuttering under, repressed need hypothesis, anticipatory struggle hypotheses and breakdown hypothesis. According to Manning (2006) models of stuttering can be classified into 1) *psychological theories* suggesting that stuttering symptoms are related to psychological or emotional conflict; 2) *learning theories* proposing that speaker learns that speaking is difficult and consequently learns to foresee stuttering and struggles when attempting to produce fluent speech; and 3) *physiological theories* proposing that a physiological break down in fluent speech is evident, particularly in response to a variety of forms of stress; and 4) *multifactorial theories* which believe in a combination of factors that lead to onset and development of stuttering. There is substantial overlap between many of the theoretical perspectives. Some theories offer better explanations concerned to onset of stuttering and others offer explanations of the subsequent development of the problem.

Some of the theories and models are reviewed briefly below to get an overall perspective on the current understanding about the nature of stuttering.

2.3.1. Speech motor aspects in stuttering

During speech different vocal tract actions are sequenced to produce a group of speech sounds. Numerous attempts have been made to establish the specific organization of speech motor actions. Speech motor actions are organized in such a way that the level of interaction exist across various speech subsystems. Speech motor control system will command the planning and execution of movement plan. Stuttering can be considered as a disorder of speech motor control. The theory that stuttering is based on an organic predisposition of a neuromuscular nature has stimulated a large amount of research on the motor abilities of stuttering. As stated by Packman, Code, and Onslow (2007), "developmental stuttering is a problem in syllable initiation in which the child is unable to move forward in speech because the speech planning system is compromised".

2.3.2. Stuttering as a defect in phonetic and syllabic contextual programming

MacKay (1970) proposed a speech production model at the phonetic level, which can account for stuttering. This model constitutes various levels of speech production. Firstly, the buffer stores the word in abstract form and generates a series of programs to modify the phonemes in reference to the context. Secondly, the buffer feeds into the individual phoneme level when the phoneme in the target word gets partially primed. But the activation is not in a serial order. Subsequently, the buffer system also modifies the phonemes according to the contextual constraints. Later the information from these levels is fed in to the motor units where the contextually variant phonemes are coded. This model also involves a scanner that scans the motor variants at a determined rate. When the scanner passes a partially activated motor variant, it gets an additional boost of excitation, thus reaching the threshold at which the series of motor commands are sent to the musculature. The author postulates that when the motor unit threshold may be lowered, a greater level of hyper excitability and a greater pre-priming duration persist in people with stuttering.

2.3.3. Stuttering as a defect in coarticulatory timing

Van Riper (1971) outlined stuttering behaviour as a word inappropriately patterned in time. He hypothesized that there is a breakdown in the temporal arrangement of coarticulatory events in the production of syllables. This temporal breakdown may occur due to various reasons. They are inability to monitor speech through tactile-kinesthetic-proprioceptive feedback, inability to integrate long motor sequences, and organic deficiencies in speech related functions. PWS exhibit physiological difficulties such as defective breathing, voicing, and articulation that could lead to the speech deficiencies. Due to this, stuttering behaviours such as syllabic or sound repetition, sound prolongation, silent articulatory postures and phonatory arrest may exist.

2.3.4. Multifactorial/Dynamic models

Multi-factorial model focuses on the complexity and multiple factors that influence one's ability to produce fluent speech. The multidimensional approaches enable one to understand the complex nature of stuttering. The demands and capacities model (DCM), multi-factorial dynamic model, neurophysiological model and stuttering as a neuromuscular disorder are classified under multi-factorial models, as it includes many factors that seem to influence fluent and nonfluent speech in persons with stuttering.

2.3.4.1. The demands and capacity model (DCM)

This model proposes a discrepancy between capacity and the demands placed on the child for fluent speech (Adams, 1990; Curlee, 2000; Starkweather, 1987; Starkweather & Gottwald, 1990). Human genotype (hereditary constitution) interact with the environment to create phenotype (outward visible expression) leading to epigenesis (nature-nurture interaction), with multiple interactions (Kelly, 2000; Smith, 1999; Smith & Kelly, 1997). The model talks about capacities which can be normal or abnormal, and of four types: (1) motoric (smooth and rapid co-articulatory movements with minimum effort); (2) linguistic (formulation of sentences); (3) socio-emotional (communicative and emotional stress); and (4) cognitive (meta-linguistic skills). The demands could be low/excessive with respect to capacities, which can be external (environmental), or self-imposed. All these capacities and demands are dynamic, varying with respect to time and if the child's capacities in motoric, linguistic, cognitive and social-emotional aspects for fluency do not equal environmental demands for it, stuttering will ensue. Genetically conditioned weaknesses in systems that support fluency (language, motor, emotional, cognitive, etc.) interact with environmental factors (external and internal demands) to precipitate and maintain fluency failure. If the linguistic demands are beyond the functional capacities of the individual, disfluencies may occur. The construction of a complex sentence may impend the functioning of fluent speech (Kleinow & Smith, 2000; Namasivayam & Van Lieshout, 2011; Rispoli, 2003; Tsiamtsiouris & Cairns, 2009).

2.3.4.2. Multi-factorial dynamic model

Smith (1999) and Smith and Kelly (1997) used the analogy of volcano/onion, to explain the inefficacy of using the surface features to explain a phenomena and that stuttering is not caused by lesions in one or more sites but some form of multi-layered interactions. The analogy emphasize on understanding the overt and covert behavior of stuttering. A dynamic and multifactorial approach relates to contribution of a variety of factors. It is well known that variability exists with regard to occurrence of disfluencies across contexts, persons and tasks involving an interaction of numerous factors.

2.3.4.3. Neuro-physiological model

According to De Nil (1999), psychological and neuro-physiological processes are not independent entities. They emphasize dynamic interplay among three levels of behavior: (a) processing (central neuro-physiological), (b) output (motor, cognitive, language, social and emotional), and (c) contextual (environmental influences). Bi-directional dynamic feedback takes place at all levels which continually influence output. The environmental stimuli and behavioral consequences are filtered through neuro-physiological processes and vary within and between individuals over time.

2.3.4.4. Stuttering as neuromuscular disorder

According to Van Riper (1990) **s**tuttering essentially is a “neuromuscular disorder whose core consists of tiny lags and disruptions in the timing of complicated movements required for speech”. The unusual responses to disturbances are automatic repetitions of part word or prolongations. Few children may persist with more disfluencies for heredity reasons while some children might outgrow from stuttering due to maturation. Children may exhibit more of escape behaviors with increasing severity of speech disorder. Escape behaviors such as struggle and avoidance are learned and can be unlearned and modified though the disruptions with timing lags cannot.

2.3.5. Linguistic/Psycho-linguistic theory

The role of language or linguistic factors in stuttering has been studied for decades now and there are many links noted by the researchers in this direction. The delay in speech and language (DSL) development in children with stuttering (CWS), some children with DSL undergoing therapy developing stuttering, reduction in syntactic complexity in highly disfluent CWS, appearance of transient normal disfluencies during the development of language in children, linguistic variables in the distribution of disfluencies, effect of pragmatic and other nature of discourse on stuttering and more phonological disorders in CWS, all point to the importance of looking at language/linguistic related aspects contributing towards stuttering. There are many theories proposed in the recent past explaining stuttering from a psycholinguistic perspective which are briefly elaborated below.

2.3.5.1. Stuttering as a prosodic disorder

Wingate (1967) hypothesized that stuttering is a prosodic disorder. He experimentally observed and provided proof that stuttering on bi-syllable words were 2.5 times > that on mono-syllable words consisting of same syllables, less stuttering on reading words of a passage as against passage reading, more stuttering in adaptation task when prosodic markers were changed, and changed prosodic features in most of the fluency inducing conditions. All these observations point to the influence of prosodic variations in the moments of stuttering. Also, the onset of stuttering is invariably during the development of phrase and sentence level, where prosodic variations are more prominent, and not during the single word utterance stage.

2.3.5.2. Supra-segmental sentence plan alignment model

Karniol (1995) proposed that PWS experience difficulty in aligning the segmental (lexical and syntactic) and suprasegmental (stress, intonation) features of utterance constituents. Stuttering mainly occur due to reasons such as, (a) "words are produced differently in sentence contexts than in isolation; (b) the way a word is produced depends on the sentence in which it is embedded; (c) sentences have suprasegmental features, including rhythm, melody, and stress, that are largely determined prior to utterance initiation and are expressed through changes in muscle movements; (d) individuals change their speech plans online, during sentence production; (e) latency of producing online changes reflects time required for lexical search, syntactic revisions, and suprasegmental sentence plan revision; and (f) word elongations and part-word and whole-word repetitions represent points of alignment of planned suprasegmental features with the revised suprasegmental features of sentences".

2.3.5.3 Variability/V- Model

It is thought that PWS present with less stable speech systems that may be disturbed by variability, and it is noted that the presence of stress contrasts in the speech sample is a basis of such variability. This model suggests that stuttering reduces when the variability of typical syllabic stress production also reduces. This implies that in unstable motor systems (susceptible to variability), the development of variable stress triggers stuttering. Thus, in this model Packman, Onslow, Richard, and van Doorn, (1996) target difficulty in the speaker's ability to encode suprasegmenatal variability (transitions between and among targets differing in stress value) as the locus of failure in stuttering.

2.3.5.4. Neuro psycho-linguistic models

These models are more abstract and provide a more schematic view of the underlying deficit in stuttering and tend to be grounded in psycholinguistic models of the normal speech/language production processes (e.g., Levelt's model, 1989). Among the more popular are the Covert Repair Hypothesis (CRH) (Postma & Kolk, 1993) and the Temporal Dyssynchrony Model (Perkins, Kent & Curlee, 1991). CRH is based on Levelt's model of speech production which contains a pre-articulatory monitoring stage, for which there is considerable evidence. The CRH states that people who stutter have a temporal impairment in phonological encoding (Byrd, Conture, & Ohde, 2007; Melnick, Conture, & Ohde, 2003). When the phonetic plan cannot proceed normally, this impairment is adapted to by covert repairs, restarts and postponements, which result in the surface or overt behavior of stuttering. Thus, stuttering is seen as a by-product or side-effect of self-repairs. It is also unclear at which stage phonological encoding or monitoring is disturbed. The Connectionist models, which describe speech production and comprehension in terms of activation of representations and their spread (spreading activation) may account for mis-selections or poorly timed phonetic plans. According to the CRH, disruptions may exist at different points in the hierarchy of linguistic system. It contains a pre-articulatory monitoring that allows the speaker to repair the error before its produced stage. Repair events are results of disruptions in the linguistic system. The disruptions are monitored via two routes: external (overt speech repairs) and internal (error corrected before the error is output) loops. Speakers sometimes make errors in phonological encoding due to the spreading-activation mechanism. Errors in the phonetic plan are detected by the internal speech monitors. If speakers detect these errors, they can interrupt speech to repair them before they are produced and such interruption ends up with disfluencies. Individuals who stutter produce more disfluencies because of a temporal impairment in phonological encoding mechanism (phonologic development and phonologic encoding are slower) that leads to frequent phonetic plan errors that must be repaired causing speech disfluencies. Stuttering itself is not the loci of repair. This theory can explain various phenomena of stuttering such as repetitions or restarts as a strategy to repair/reduce phonological encoding errors. Upon the detection of error, speech is interrupted and as the interruption is immediate, disfluency occurs within the word. Occurrence of error detection can be early (silent pauses, tense pauses and blocking), intermediate (sound repetitions, prolongations), or late (part word repetitions, prolongation of non initial sound, broken words) That is, restart from the beginning of the word but part of the word's onset would not be articulated due to the use of postponement strategy, or delaying articulating part of the word to allow activation process more time and increase the chance of selecting intended unit.

The CRH model drew its conclusions from the Connectionist model by Dell and O'Seaghdha (1992). This model assumes that when an individual intends to produce a target word, a phonologically-related competing word is also simultaneously triggered. Through the initial stages, both the target and competing words have comparable routes of activation. Afterwards, on asymptote, the target word would have achieved superior activation levels, thereby guaranteeing the generation of the target unit as output. Under temporal constraints, a speaker has to rapidly articulate the target in the initial time frame when the two words (target and competing word) have comparable routes of activation. The authors proposed that the inappropriate selection of words typically occurs on content words. In this regard, disfluencies such as prolongations, repetitions, or interruptions (filled and unfilled pauses) may reflect covert repair activity (Howell, Kadi-Hanifi & Young, 1991). Thus the CRH provides some explanation as to why the function words that frequently precede content words (which are the actual source of error) are most often disfluent.

2.3.5.5. Temporal dyssynchrony model (Perkins, Kent, & Curlee, 1991)

According to this, stuttering is caused when sounds are not inserted in a timely fashion into syllables during speech production i.e., when articulatory rate exceeds the rate at which segments can be integrated synchronously into their syllable frames. The two neural systems that are responsible for this insertion process include, the symbol system concerned with linguistic processing, the signal system responsible for providing syllable frames especially vulnerable to cognitive conflicts. Dysynchrony in the two neural systems and subsequent speech disruption is due to delay in the arrival of the syllable frames which contain the slots into which speech segments are to be inserted. Various possible reasons for this dysynchrony (Perkins et al., 1991) include self expressive uncertainty, i.e., where the urgency to speak out with a feeling of not privileged to speak out, inefficient neural resources due to genetic constraints, brain injury or competition for processing capacity. The authors refer to stuttering resulting from a delay in linguistic processing as linguistic stuttering which can be the result of segmental processing inefficiency due to interference mechanisms and slowed processing or ineffective activation of the components that contribute to the final act of speaking.

2.3.5.6. The EXPLAN theory of stuttering

According to EXPLAN (Howell & Au-Yeung, 2002) fluency failures arise because the amount of time taken to plan and execute these segments varies. The linguistic formulator process generates a plan (PLAN) and motor processes execute it (EX). The basic assumption of this model is that PLAN and EX is parallel and independent of each other. The feedback from EX output is fed to a central monitor that uses it to correct and reinitiate a PLAN. The independence also allows the simultaneous execution of the current word and planning of the subsequent. Time constraints may be imposed on planning during the rapid execution of the planned segment. Although ordinarily the planning process delivers a plan ahead of execution (Sternberg, Monsell, Knoll & Wright 1978), in the circumstances just described, the process can falter. In this scenario, only the left-most part of the plan is ready at the point of execution. Consequently, speech may be interrupted until the rest of the plan arrives (stalling) or the speaker can continue to attempt speech with only the incomplete plan (advancing). This leads to specific types of disfluencies commonly exhibited. The differences in disfluencies between children and adult depend on the various strategies that they employ to cope with the underlying problem.

2.4. Language abilities in CWS

Interest in the language and linguistic determinants related to stuttering has been the focus of research since early 1930s and continues till date all over. This interest is due to many factors such as (1) the onset and development of stuttering during early language acquisition period after a period of normal development, involving relatively quick spurts of language growth and the acquisition of several morphological and syntactic forms, (2) influence of most of the linguistic variables in the moments of stuttering, (3) influence of various linguistic demands on the varied capacities of children during this preschool period when most of the onset of stuttering is reported, and (4) most of the spontaneous recoveries and successful recovery with treatment reported during this early period of language development. There are many investigations undertaken to explain these phenomena as possible contributors for breakdown in fluency.

2.4.1. Stuttering onset and language development

In the recent years there has been increased curiosity to study the association involving language and fluency in young CWS (Logan, 2003; Yaruss, 1999; Yaruss, LaSalle, & Conture, 1998). Stuttering can occur at any age, but the onset in vast majority is between two and five years (Johnson, 1959, Yairi, 1983). The onset of stuttering coincides with the period of significant language growth when CWS start attaining the capacity to generate progressively more complicated sentence forms (Owens, 2012; Yairi, 2004). During this period mastery of morphological and syntactic forms takes place. It appears that the earliest reported onset of stuttering is 18 months - approximately the time children begin combining two words as noted by Bloodstein (1995).

Linguistic maturation includes a progressive improvement in vocabulary and and greater usage of complex syntactic forms. The experimental manipulation of grammatical complexity might aid in understanding the relationship of expressive language and disfluencies (Muma, 1971; Haynes & Hood, 1978; Bloodstein, 1981). It is important to note the age interval of approximately 3-5 years as the onset of stuttering and it also coincides with the mastery of key language features. The plausible etiological factor accounting for stuttering according to Van Riper (1973) and Bloodstein (1981) was the apparent difficulty in language acquisition and mastery. Although several investigations have suggested the interaction between language development and stuttering, another group of researchers did not obtain such statistically significant variability in the linguistic abilities of CWS and CWNS (Johnson, 1959; Perozzi & Kunze, 1969; Murray & Reed, 1977; Riley & Riley, 1979).

The issue of whether CWS differ from CWNS with regard to language abilities has been a divisive subject since the early 90's. The findings from experiential research on this population have been less than constant. Bloodstein (2001) described incipient stuttering as distinct from the disfluencies exhibited by older children and adults. It is evidenced by numerous instances of repetitions on whole words and at the initial segments of an utterance and the lack of it on concluding segments. Early stuttering is not influenced by factors like word length, grammatical category and is not evident during the single word stage of linguistic maturation.

Several researchers explain incipient stuttering as a possibility of the child to present with some type of language difficulty. The exhibited problems could be related to grammatical complexity, ease of retrieval, or the motoric programming of syntactic units. Supporting Bloodstein's hypothesis, some investigators have found reduced linguistic abilities in young CWS. Numerous studies have tried to account for language disparities in developmental stuttering by probing the variability in speech and language measures of normal and disfluent children. Particularly, majority of the investigators report of reduced language abilities in young children who stutter, whereas others have reported no significant differences, while still others have stated that disfluent children exhibit superior language abilities.

2.4.2. Studies supporting deficient or delayed language abilities in CWS

Berry (1938) noted that CWS tended to be late talkers in comparison to normal peer group. In the year 1974, Westby explored the syntactic and semantic performance in children groups. Her results showed markedly poor receptive vocabulary scores, greater syntactic errors and reduced accuracy on the semantic tasks for CWS and the highly disfluent CWNS. The presence of a language deficit may jeopardize the child’s likelihood of being fluent (Bajaj, 2007; Bernstein Ratner, 1997; Blood, Ridenour, Qualls, & Hammer, 2003).

A constituent syntactic analysis of the speech of four CWS and four CWNS aged 5-6 years was carried out by Wall (1980). Variability was reported for the usage and types of clauses, and complicated utterances between both groups. There was greater use of one-word responses and limited use of complex sentences by CWS. Additionally, CWS demonstrated a marked utilization of one conjunction (‘and’) at the cost of others, and tended to utilize coordinate clauses which did not begin with a coordinate word, in comparison with the normal children. They further demonstrated more immature usage of certain morphological markers (e.g., "that"). Children with stuttering were found to demonstrate paucity of whole sentences and grammatical complexity. Reduced vocabulary and/or subtle lexical difficulties have been observed in both AWS and CWS, on formal measures of language ability (Arnold, Conture, & Ohde, 2005; Watson, Freeman, Devous, Chapman, Finitz, & Pool, 1994; Westby, 1984).

The narrative ability (story re-telling) of eight normal and eight CWS in the age range of 5-11 years was evaluated by Weiss and Zebrowski (1994). Analysis of story length and complexity by CWS revealed some non-significant differences. Majority of the times the stories produced by CWS were brief and lacked completeness compared to their matched fluent peers. The study also highlighted the need of obtaining discourse samples during complete assessment protocol among young CWS.

The language abilities of 15 children close to their onset of stuttering symptoms and age-gender-matched fluent children were assessed by Bernstein Ratner and Silverman (2000). Their results alluded to a lower performance on every aspect of speech and language by the CWS group. The results of Anderson and Conture's study (2000) demonstrated significant variability between formal measures of total language and receptive vocabulary in 20 CWS. Disfluent children, on the measure of total language, outscored their receptive vocabulary measure by approximately 30 points. In the same way, fluent children also illustrated a similar trend, but obtained a lower difference in scores between the 2 measures (approx. 13 points). They opined that young CWS may present with a disproportionality between the various constituents of their linguistic system (Anderson, Pellowski, & Conture, 2005).

A correlation-based analysis on 4 standardized speech-language measures, namely, the Goldman-Fristoe Test of Articulation (GFTA-2), Peabody Picture Vocabulary Test (PPVT-III), Expressive Vocabulary Test (EVT; Gardner, 1990), and the Test of Early Language Development (TELD-3) was performed by Anderson et al. (2005). Between-group results revealed that children who stuttered had poorer scores than their fluent peers on the TELD-3 subtests. Their findings suggested that on the whole children who stuttered had reduced linguistic abilities (solely on TELD-3) than matched fluent peers. More than half of the CWS had linguistic dissociations as against 14% of the CWNS; insinuating that certain linguistic abilities may be deficient in disfluent children.

In a meta-analytical review examining the linguistic abilities of CWS, Ntourou, Conture and Lipsey (2011) summarized evidence from 35 studies and estimated the mean difference effect size. Their results revealed that CWS exhibited poorer scores than their normal counterparts on measures of total language, receptive and expressive vocabulary. The details are as follows:

(i) *Overall language:* 11 studies examined total language abilities of disfluent children and their fluent peers on norm-referenced tests of language (e.g., Test of Early Language Development, TELD-2). The findings indicated that disfluent children, on the whole, scored nearly half a standard deviation below the control group.

(ii) *Receptive vocabulary:* 16 studies examined the receptive vocabulary of disfluent and fluent children with standardized receptive vocabulary tests (e.g., Peabody Picture Vocabulary Test- Revised, PPVT-R). The findings indicated that disfluent children, on average scored about half a standard deviation below the group with fluent children.

(iii) *Expressive vocabulary:* 8 studies examined the expressive vocabulary of disfluent and fluent children with the use of standardized tests of expressive vocabulary (e.g., Expressive Vocabulary Test; Williams, 1997). The findings indicated that disfluent children, on average, scored about half a standard deviation below the control group of children.

A recent study by Bauman, Hall, Wagovich, Weber-Fox and Bernstein Ratner (2012) analyzed the occurrence of irregular past-tense verbs among 31 CWS and 31 CWNS within the ages of 24 - 59 months. The results indicated that children in both groups tended to regularize irregular words, specifically in relation to verbs (“runned” for “ran”). The non- significant variations included the tendency to double-mark verbs (“ranned” for “ran”) and restrictive and less diverse usage of verbs on the whole (St. Louis, Hinzman, & Hull, 1985; Wagovich & Bernstein Ratner, 2007). Interestingly, on a primed noun-naming task, CWS demonstrated a definitive advantage when primed with verbs, while a similar trend was observed for CWNS when primed with other nouns (Hartfield & Conture, 2006). These studies lend credit to Bernstein’s (1981) hypothesis that utterances beginning with verb-phrases were more prone to be disfluent.

Perkins, Kent, and Curlee’s (1991) model advocates “that when one language skill is below the level of other language components, the production of language is then thrown out of balance as different components arrive at a central language integrator at different times and thus have a mistimed impact on the motor production of speech”. Several researchers have noted that CWS, as a group, demonstrate a liability for more fragile or disordered linguistic abilities than CWNS (Anderson, Wagovich, & Hall, 2006; Bloodstein, 2006; Ntourou, Conture, & Lipsey, 2011; Tetnowski, Richels, Shenker, Sisskin, & Wolk, 2012).

2.4.3. Studies supporting similar language abilities in CWS

Another group of researchers emphasized similar language abilities in CWS compared to CWNS. Nippold, Schwarz and Jescheniak (1991) assessed the narrative abilities as well as expressive and receptive language development of ten school-aged boys with and without stuttering. Their results did not lend support to the hypothesis of a delayed/deficient language development in the CWS group. Their results were in concurrence with that of Bernstein Ratner and Sih (1987). Similar findings were also reported by Bonelli, Dixon, Bernstein Ratner and Onslow (2000), and Bernstein Ratner, Newman and Strekas (2009). Following a common thread, examining the linguistic abilities of preschoolers with stuttering and their typically developing peers provided no evidence supporting the claim of disordered language abilities in CWS compared to their fluent peers (Bajaj, 2007; Howell, Davis, & Au-Yeung, 2003; Kloth, Janssen, Kraaimaat, & Brutten, 1998). However, only few studies have been reported that support similar language abilities in CWS compared to CWNS.

2.4.4. Studies supporting advanced language abilities in CWS

Yet another set of researchers explored advanced language abilities in CWS compared to CWNS. Reilly et al. (2009) conducted a longitudinal, community cohort study of young Australian children sampled at 8 months and followed up to the age of 3 years. They documented higher vocabulary scores in children, with early onset of stuttering not associated with a language delay. Their results reproduced the findings of Hage (2001) and Watkins (2005). Bloodstein (1995) suggests that the "linguistic disadvantage" seen in the speech repertoire of preschool CWS become inconspicuous as age progresses, perhaps shedding light on the equivocalness of findings among school-age CWS and CWNS (Perozzi & Kunze, 1969; Williams, Melrose, & Woods, 1969).

2.4.5. Language abilities of monolinguals and bilinguals

Researchers have reported that bilinguals perform better on cognitive issues over monolinguals which contributes toward linguistic development, perception, attention and inhibitory control (Cook, 1997). Klein, Zatorre, Milner, Meyer, and Evans (1994) examined the notion that "the knowledge of two languages is greater than the sum of its parts." The benefits of bilingualism facilitate the child's understanding of the structure of language, achieve a superior awareness of meanings, an increase in metalinguistic awareness and recognize words in continuous speech (Adesope, Lavin, Thompson, & Ungerleider, 2010; Bialystok, 1988). Martin-rhee and Bialystok (2008) reported that the bilingual advantage was predominant in tasks of interference suppression (e.g., controlling attention to competing cues) but not in tasks of response inhibition (e.g., control over competing responses). Kapa and Colombo (2013) also lend support to the notion of bilingual advantage, wherein bilinguals outrivaled monolinguals on a range of cognitive tests, signifying advantages in cognitive control.

On the other hand, researchers have found better performance among the monolinguals compared to bilinguals. Bialystok, Luk, Peets, and Yang (2010) analyzed the vocabulary difference in children within the ages of 3 and 10 years of age. Their results demonstrated a consistent disparity in receptive vocabulary between monolinguals and bilinguals. It lends support to the speculation that bilinguals possess a smaller vocabulary in a language than monolinguals. Accordingly, Bialystok (2009) reports that bilinguals performed more poorly on verbal recall memory tasks but better than monolinguals on memory tasks involving executive control. Bilingualism relates to a linguistic deficit, possibly due to a language interference or lack of mastery of the specific vocabulary in particular to that language (http://leap.tki.org.nz/Why-do-bilinguals-switch-languages). Bialystok, Craik, and Luk (2008) examined the lexical access and indicated that monolinguals often had a more expansive vocabulary in their native language compared to bilinguals.

The vocabulary scores in monolingual children seem to be larger while as bilingual children increase with age they demonstrate larger vocabulary scores (Core, Hoff, Rumiche, & Senor, 2011). The authors also report of no absolute differences in total vocabulary size or total vocabulary gains amongst both groups of children; suggesting that both sets of children have similar vocabulary sizes and gain the same vocabulary knowledge. Ransdell and Fischler (1987) examined the latency of recognition of a lexical decision task to a list of abstract words and found slower response rates from bilinguals compared to their monolinguals peers. Magiste (1980) attributes this reduced response rates to be due to a differential familiarity with the native language. Ivanova and Albert (2008) investigated claims that a bilingual is at a linguistic disadvantage in lexical access and reported of results supporting these claims, meaning to say that monolinguals could name the pictures presented faster than bilinguals in the first/native language. Gollan, Montoya, Cera, and Sandoval (2008) commented on this “weaker links” hypothesis which proposed that bilinguals are at a distinct disadvantage relative to their monolingual peers on verbal tasks as they are required to effectively divide the frequency-of-use between both languages.

2.4.6. Language abilities of CWS in Indian context

Research by investigators examining the aspects of language abilities of CWS in the Indian context has been relatively limited. However, some notable findings are summarized as follows. In a study assessing the syntactic abilities of 7 preschoolers with stuttering within the age range of 2 to 4 years, Prachi (2001) noted lower overall scores on STASK in CWS. However, only one child with stuttering scored higher than an age-gender matched control. A similar trend was observed in the syntax comprehension scores of STASK. A lower score on the syntax expression section was noted for CWS with the exception of 2 CWS – one who scored higher than the age-gender matched control and the other who scored on par with the control subject. In a recent study, Yashaswini and Geetha (2011) examined linguistic and metalinguistic abilities in CWS within the age range of 8 and 12 years. They reported poor performance of CWS (10-11 year old) when compared to CWNS on the phonology task. No statistically significant difference between performance of CWS and CWNS was noted on semantics section of the LPT. The MANOVA results revealed significantly poor performance in CWS on syntax and all metaphonological tasks except rhyme recognition and phoneme oddity.

Geetha (1996) investigated the concomitant speech-language problems in CWS within the age range of 2-6 years (18 males and 8 females) and found articulation and language problems (25%), language delay (25%), articulation (6.25%) and voice problems (6.25%) in these children. She also reported of delayed onset of speech in 6.25% of children and commented on the possibility of some early minimal brain damage leading to the delay, which could possibly precipitate disfluencies.

Pushpavathi (2004) attempted verification of subgroup and interference hypotheses proposed by Peters and Starkweather (1990) and found the presence of subgroups among CWS thus supporting the hypotheses. Canonical Discriminant Function Analysis was used to subgroup CWS and a total of 12%, 17%, and 1% of children were sub grouped under '*purely motoric', 'purely linguistic'*, *'motoric and linguistic'* respectively and the remaining under *none of the three*. She opined that children sub grouped under predominantly motoric, predominantly linguistic and motoric and linguistic can be particularly helped with motoric and linguistic aspects. Many researchers (Prins & Lohr, 1972; St. Onge, 1963) admit that the "Average stutterer" is non-existent and that there are no traits that are common to all PWS. Thus, the average performance or characteristics of group of CWS should not be considered to be representative of CWS in general.

Yet another recent study was carried out by Beena (2014) with the aim to evaluate previous claims of a deficiency in the language abilities of CWS at the concurrent periods of language acquisition. The semantic, syntactic and overall language abilities were evaluated among 10 CWS in comparison with CWNS. The results of the study, however, did not support the hypothesis of a glitch in the overall language abilities of the CWS in relation to their fluent counterparts. Nevertheless, a comparison of group means on the subtests of the Kannada language test implicitly hinted at a slightly better performance by the CWS as compared to the CWNS though not significant. Additionally, within group comparison showed a significant difference between reception and expression in both groups, indicating that the receptive abilities were better developed than expressive abilities. Sub-grouping of CWS based on their language profiles/scores into advanced, low, or average language abilities, would assist clinicians in gleaning information on a child's performance and further aid them in guiding parents in terms of the linguistic demands placed on the child.

To summarize, the review of literature on language abilities in CWS revealed mixed results. Majority of the studies from 1938 to 2011 found presence of imbalance among the components in speech language systems in preschool CWS. The findings indicated that CWS had poorer scores on standardized test measures for total language, receptive and expressive vocabulary than CWNS. On similar lines, in the Indian context, researchers found poor performance in CWS on syntax and most of the meta-phonological tasks. Few studies (e.g., Nippold, Schwarz, & Jescheniak, 1991) did not report any kind of language deficit in CWS as a group suggesting similar pattern in comparison with normals. Another small group of researchers pointed toward confirmed higher vocabulary scores in CWS with early onset not associated with a language delay. Similarly, in the Indian context it was found that CWS performed slightly better in the overall language score compared to the CWNS though not significant and some studies showing poorer performance by CWS. The mixed results suggest nonexistence of universal agreement with regard with regard to language delay or deficiency in CWS and no traits are common to all PWS.

2.4.7. Severity of stuttering and language abilities

The studies that examined the language abilities and degree of severity of stuttering are as follows. Hall, Yamashita, and Aram (1993) examined the linguistic determinants in 60 preschool CWS and reported relationship between an imbalance in aspects of language such as, heightened lexical abilities and reduced morpho-syntactic skills; and an increase in disfluencies. Their findings were explained based on the neuro-psycholinguistic model proposed by Perkins, Kent, and Curlee (1991) which postulated that imbalances in speech and language processes lead to disturbances in fluency. Researchers also emphasize on aspects as few children with language deficits may be susceptible to failures in fluency because of asynchrony in the development of vocabulary and grammar of language or as a result of mismatch between demands and capacities during a speaking task.

Silverman and Bernstein Ratner (2002) studied lexical diversity from the speech samples of CWS and their fluent peers, and found a negative correlation SSI and Type Token Ratio. When the scores on the SSI increased (demonstrating greater severity), the value of the TTR reduced (demonstrating poorer lexical diversity). The authors found that a higher lexical diversity (high TTR value) correlated with less overt stuttering (low SSI score). They attributed this association to avoidance behaviours and possibly more fundamental language problems.

Millager, Conture, Walden, and Kelly (2014) studied expressive language intra-test scatter on the expressive subtest of the Test of Early Language Development (TELD – Exp; Hresko, Reid, & Hamill, 1999) in 40 preschoolers with stuttering, and found a significant positive correlation between the results of Expressive Vocabulary Test and frequency of stuttering; suggesting that an primary cognitive linguistic variable (e.g., cognitive load) maybe common to both speech-language performance and stuttering. These findings appear to suggest that "CWS show subtle disturbances in their developing speech-language systems, with more frequent stuttering associated with greater vulnerabilities related to the planning and production of expressive language". Consistent with this assumption, Ntourou et al. (2011) suggested that, "when planning/formulating sentences, CWS may experience subtle but important difficulties in quickly and efficiently encoding and retrieving lexical items"

Some researchers noted no significant correlation with regard to language abilities and stuttering severity. Anderson and Conture (2000) found no significant correlation on the comparison of receptive/expressive language and receptive vocabulary scores with the overall stuttering frequency of CWS. Salihovic, Junuzovic-zunic, Duranovic and Fatusic (2010) studied the semantic abilities in 58 school-age children with stuttering between the ages of 6 to 15 years. The findings demonstrated majority of children exhibited moderate degree of stuttering. The comparisons of vocabulary scores showed poorer results in CWS compared to CWNS. No significant correlation was noted across severity of stuttering and variables related to vocabulary characteristics in CWS.

2.5. Stuttering and bilingualism

Weinreich (1953) defined “bilingualism as the alternate use of two languages”. The term bilingualism in a broader sense refers to “the total simultaneous and alternating mastery of two languages” to “some degree of knowledge of a second language in addition to spontaneous skills which any individual possesses in his/her first language” (Siguan & Mackay, 1987). The proficiency in known languages may not be even across persons and languages (e.g., Grosjean, 1994).

Kohnert, Bates, and Hernandez (1999) profiled lexical processes in first and second language in 100 early sequential Spanish-English normal bilinguals. The participants were within the ages 5 to 20 years. The experimental task emphasized processing abilities of the vocabulary. The results showed a clear intersect from first to second language proficiency with advanced age. However, a loss in language was not evident in first language. These findings ascertain additional support to the concept of first language (L1) as one’s convenient and most comfortable language.

2.5.1. Influence of language proficiency

The language proficiency assesses one’s efficient use of grammatical markers, extensive word usage, and clear articulation of sound with appropriate prosody during speaking task. It is noted that as children are exposed to languages they could exhibit unequal knowledge of the known languages. The knowledge and use of languages play a significant role in bilingual CWS. Meanwhile, Bedore and Pena (2008) commented that children might exhibit delay in language when exposed to more languages in early childhood. In addition, if a child uses any language for brief duration, there is a definite tendency to produce normal nonfluencies. Such conditions may be considered as over-identification of stuttering and the misdiagnosis might be noted (Tanner, 1999). Thordardottir (2006) opined that languages exhibit varied pattern with regard to linguistic structure and hence cannot be compared directly. Bilingual children may interchange word order in one language based on another known language. There is a tendency to use stronger language most of the time by bilingual children. While assessing the linguistic proficiency in CWS, conversational task, narration, reading and naming pictures may be considered in both the languages (Roberts & Shenker, 2007). The findings across the tasks should then be analysed with the standards recognized for specific language (Paul, 2007).

2.5.2. Stuttering in bilingual children

One of the consistencies with stuttering relates to its presence in every language of the world. With increase in literacy rate, children are exposed to more languages along with their mother tongue. In the past, researchers observed that stuttering was mostly evident among bilinguals compared to monolinguals (Stern, 1948; Travis, Johnson, & Shover, 1937). On the other hand, Au-Yeung, Howell, Davis, Charles, and Sackin (2000) performed online analysis and indicated no similar frequency of occurrence among both the groups. Hence, the findings on bilingualism linking with stuttering favoured varied pattern. It is possible that distinct pattern relates to various methodology used across studies including age of participants, known languages, language use, knowledge and process involved during assessment of bilingual stuttering.

2.5.3. Prevalence of stuttering in bilingual children

Stuttering seems to be more prevalent in bilingual individuals compared to monolinguals (Eisenson, 1984; Karniol, 1992). Travis, Johnson, and Shover (1937) screened participants in the age range of 4 to 17 years. Children were assessed for the presence of stuttering based on reading and conversation sample. The overall prevalence of stuttering was 2.61% among children. They found significantly poor prevalence of stuttering in monolinguals (English) in comparison with children speaking more languages. On the similar lines, Stern (1948) examined 1861 children from South Africa. The author noted that the prevalence rate was 1.66% for monolingual CWS and the prevalence was higher in bilingual CWS which was around 2.16%. Moreover, the severity of stuttering was greater among bilinguals than monolinguals.

A single case study considering bilingual CWS who used Hebrew-English languages was investigated by Karniol (1992). The author assumed an association while linking the early stuttering and bilingualism. The reason put forth for the occurrence of disfluencies in the study was linked with linguistic overload specifically to sentences. She opined that the findings were in principals of neuroscience model. Nudelman, Herbrich, Hoyt, and Rosenfield (1989) proposed neuroscience model that "explain disfluencies to reflect moments of instability in a multi-loop system. Speech motor control involves two major control loops, an outer loop for ideation and linguistic programming and an inner phonatory loop for motor programming of the vocal apparatus. Bilingualism may possibly lead to instability as a result of the additional processing time required for either the outer loop, inner loop or both". Another theory relating bilingualism and stuttering is the Demands and Capacities model (Starkweather, 1987). This model proposed that, "stuttering occurs when a child lacks capacities to meet fluency demands. It could be assumed that, in bilingual CWS, using two languages places demands on them that might exceed their capacities". However, dissimilarity in terms of prevalence of disfluencies across both the groups, monolinguals and bilinguals cannot be attributed only to bilingualism.

Lebrun and Paradis (1984) addressed the issue of difficulty to maintain fluency in young bilingual children. Interestingly, bilingual children receive excessive linguistic stimulation from the environment. Although a positive impact of increasing vocabulary exists, children might also have negative impact of stuttering when exposed to more languages. The authors argued on the presence of confusion while selecting the appropriate word, possibly caused due to linguistic cross over from learnt languages.

Some researchers have addressed the issue of influence of each of the known languages in a bilingual individual on stuttering (Van Borsel & Britto Pereira, 2005). Both the languages may have a similar or dissimilar linguistic structure. However, no studies are investigated in this direction that compared the nature of linguistic constituents of known languages linking to stuttering. It is hypothesized that children might exhibit uncertainty or confusion in case of similar linguistic structure in languages and hence results in disfluencies. In addition, using diverse linguistic lexicon from two languages may place increased demands and hence further results in disfluencies.

2.5.4. Early/ Late bilingual child with stuttering

Depending on the age of exposure to two or more languages, bilinguals can be classified as early and late bilinguals. Seeman (1974) opined greater risk of stuttering in the presence of early bilingualism. Au-Yeung et al. (2000) conducted a survey on 794 individuals to obtain more information about the occurrence of stuttering in monolinguals and bilinguals. They also investigated the relationship between the age of language acquisition and stuttering. The survey collected personal information, various aspects of language usage, and self-reported proficiency level of the known languages. The results indicated no significant difference in the frequency of PWS between bilingual and monolingual persons for either gender population. Also, it was seen that “middle bilinguals” were less disfluent than did “early” or “late” bilingual individuals. However, the findings should be considered with caution as the possibility of confused stuttering with normal non-fluencies may arise with some respondents. Some researchers claim that children are susceptible to develop stuttering if they are exposed to two languages at young age. Interestingly, stuttering onset has never been reported in adults learning a second language.

Studies relating to learning second language in adults and children are not conclusive according to Larsen-Freeman and Long (1991). Few researchers opined that learning second language involves a similar course inspite of whether it is learnt during early years or adulthood. In contrast, other researchers claim that the process of acquisition differs in both the groups.

Kim, Relkin, Lee, and Hirsch (1997) hypothesized that, “once cortical representations of languages are created in early life, they are not altered subsequently. This aspect enables one to utilize adjacent cortical areas for second languages learned later in life. As far as stuttering in bilinguals is concerned, the finding that the same brain areas are recruited for learning and processing both languages in early bilinguals whereas multiple and variable and different areas are recruited in late bilinguals is interesting. It can be hypothesized that early bilinguals are more vulnerable to stuttering precisely because the same brain structures are utilized for learning both languages, and stuttering reflects a functional overload of these structures. Late bilinguals or adults learning a second language, in contrast, would be far less prone to stutter because different structures are recruited for the second language. However, age of acquisition may not be the only determinant of the cortical representation of a second language". Perani, Paulesu, Galles, Dupoux, Dehaene, Bettardini et al. (1998) studied bilinguals using positron emission tomography (PET) with the knowledge of Italian-English languages. The authors reported that complete knowledge of language plays a significant role in cortical representation of a second language.

The findings of Howell, Davis, and Williams (2009) supported the fact that pre-school children may possibly are susceptible to develop stuttering if they are exposed to more languages during early childhood. The authors suggested that the occurrence of stuttering in preschool children can be prevented only by exposing the child to second language in the later years after complete development of first language. However, they suggested that the findings should be considered with caution and further studies are warranted considering early and late bilingualism.

2.5.5. Manifestation of stuttering in bilinguals

Nwokah (1988) proposed various probabilities to demonstrate the appearance of stuttering in bilinguals. "One possibility is that stuttering occurs in one language but not the other". Nwokah suspected that this condition would be rare, and if such finding is noted then one language is more proficient than other language. Nwokah analyzed the stuttering behavior of balanced bilinguals between the ages of 16 and 40 years in Nigeria. Samples of reading aloud (300 words passage) and conversation were analyzed. It was seen that stuttering did not vary for both languages, Igbo and English.

Dale (1977) conducted a study considering bilingual adolescents with proficiency in Spanish and English. Author mentions that the participants did not present disfluencies in English, conversely disfluencies were present only in Spanish. According to the author, sociological and cultural factors may be responsible for expression of such pattern. As the participants were uncertain about appropriate Spanish words, they demonstrated normal disfluencies and were perceived as abnormal disfluencies by caregivers. These findings substantiate hypothesis of Nwokah (1988) that stuttering restricted to particular language may occur due to unbalanced language proficiency.

The second possibility is that "stuttering occurs in both languages: the same hypothesis". In support to this hypothesis, a study done by Van Riper showed that few PWS appeared to demonstrate an identical pattern of stuttering in both languages. Another study supporting the second possibility was explained by Lebrun, Bijleveld, and Rousseau (1990). They provided details about a client, French-Dutch speaking male who actually started stuttering consequent to brain damage. Authors noted that the disfluencies were affected in both languages equally. A review of literature suggests that in case of neurogenic stuttering the difficulty is more pervasive and disfluencies would be evident in various speech tasks (Ringo & Dietrich, 1995). Therefore, the client details provided by Lebrun et al. (1990) should be viewed in terms of neurogenic symptoms. Mysak (1960) proposed that if stuttering pattern is changed or altered by fluency shaping techniques, then the pattern across languages may not vary. On the similar lines, Jayaram (1977) examined ten bilingual PWS and noted identical pattern of stuttering in known languages, Kannada and English. However, varied patterns were observed in rate of speech which was slower in Kannada compared to English.

The third possibility was "stuttering occurs in both languages: the difference hypothesis". It addresses that bilingual PWS present distinct pattern of disfluencies in both languages. This hypothesis arises from two main factors. According to Krause (1982) and Fransella (1972), the first concern is related to the situation, psychological state in specific to attitude shown by PWS. The second concern relates to the importance of each language in the society. It is also noted that the difference of stuttering pattern could be because of the influence of structure of the languages. Several authors noted consistency with difference hypothesis, including Nwokah (1988). Analysis indicated that stuttering occurred more frequently on initial consonants than vowels in English whereas in Igbo it was different pattern. The participants actually would have an understanding of easy and difficult languages with regard to stuttering. Such a disproportion in stuttering behaviour is explained that links to increased planning and kind of expectation involved which might have a positive and negative impact in PWS.

According to the linguistic or motor models of stuttering, there may be "varied ways of organizing motor output in a language that the speaker is more fluent in (the speaker's first language) that hamper language output and ways of organizing output in a language that the speaker is less fluent in (the speaker's second language) that assist or augment language output" (Klein, Zatorre, Milner, Meyer & Evans, 1994). Fiedler and Standop's (1983) proposed neuropsychological model explained as, "monitoring system was similar for the second language production. Such monitoring system would act as an inhibitor that creates a conscious control of stuttering. For others, it would act as an activator that elicits tension and anticipation and increased stuttering. In addition, socio-psychological aspects such as negative experiences at school or at home also appeared to play an important role".

In the Indian context, Jayaram (1983) examined 10 bilingual PWS within the ages of 19 to 32 years. Kannada was their major language and English was the second language. He noted that the distribution of stuttering did not differ significantly in both the languages. Additionally, few PWS differed while analyzing the severity, but not for the type of disfluencies. Shenker, Conte, Gingras, Courcey, and Polomeno (1998) also proved this phenomenon in a single case study. They concluded that increased disfluencies were noticed in English compared to French in a young child. They related such findings to insufficient language growth in both the languages. It was also reported that French mostly incorporate words with single syllables and hence word repetitions was predominantly evident.

Bernstein Ratner and Benitez (1985) mentioned that their bilingual client had increased stuttering in English when compared to Spanish. On the similar lines, Howell and Au-Yeung (2007) compared the patterns of stuttering in Spanish monolinguals and Spanish/English bilinguals, who had Spanish as their dominant language (imbalanced bilinguals). The results showed that participants had increased amount of disfluencies in

Spanish language. Also, disturbances with fluency were most affected in monologue in comparison to spontaneous speech. Similarly, Jankelowitz and Bortz (1996) found that in the bilingual client an increased normal and stuttering like disfluencies were noticed in Afrikaan and English language respectively. It was observed that the participant had advanced proficiency and expressed reduced disfluencies in the predominant language, Afrikaan. This lead to the supporting fact that disfluent behaviour and the knowledge about the languages are inter-connected. Vassiliou, Stahl, and Gillam (1997) also indicated that the factors such as linguistic competence, task demands and supra segmental aspects of both languages affected fluency.

The hypothesis that distribution of stuttering may or may not be identical across languages was examined by Howell, Ruffle, Fernandez-Zuniga, Gutierrez, Fernandez, O'Brian, and Au-Yeung (2004). They analyzed spontaneous speech of CWS, who were monolingual Spanish and Spanish-English speakers. Preschool monolingual children found increased number of disfluencies for function compared to content words while older children had reduced difference between the two. The authors observed that in Spanish children exhibited a pattern identical to that of adult speakers. They opined that bilingual CWS demonstrated various approaches to cope up with fluency difficulties in both languages. As mentioned by Klein, Zatorre, Milner, Meyer, and Evans (1994), the organization of motoric information with regard to fluent and disfluent languages are actually arranged in various ways.

In the Indian context, Sneha, Shruthi, and Geetha (2008) studied the pattern of distribution of stuttering in 10 adult bilingual PWS. Their findings revealed no significant difference in stuttering in the two languages with regard to severity and percentage of disfluencies. But they found individual variations with regard to different speaking conditions. Leah and Geetha (2010) also studied differences in the disfluency characteristics between the languages (Kannada and English) within the ages of 16-40 years in 12 bilingual PWS. Analysis of stuttering like disfluencies presented increased disfluencies in Kannada, the mother tongue of participants. However, they also pointed inconsistent findings considering the degree of severity across languages.

Taliancich-Klinger, Byrd, and Bedore (2013) also provided support to the differential pattern of disfluencies in a single case study. A bilingual Spanish–English child produced increased stuttering like disfluencies in the first language, Spanish during narration task. On the other hand, other disfluencies were predominantly noticed in second language, English of the client. On comparing across tasks, narration had more disfluencies against conversation in English. They highlighted the fact that disfluent behaviours are task specific as well as language specific phenomenon in a bilingual child who stutters. Studies have addressed the importance of using narrative tasks as the tasks have the capacity to reveal subtle language deficits in children, otherwise neglected in the norm-referenced language tests (Nippold, 2010; Roth & Spekman, 1986; Westby, 1984).

In conclusion, it can be said that the relationship between stuttering and bilingualism can be mysterious. From the various studies done it can be seen that there is disparity in the findings on bilingual PWS. Thus, it calls for further research in this area. India is a country famous for multilinguilism and multicultural aspects. Majority of children in India learn more than one language during the preschool years and in school environment. Children are at advantage in learning their mother tongue, regional language and other languages which would depend on the medium of instruction at school. Limited studies are available in the Indian context that involved understanding of monolingual and bilingual context in stuttering.

2.6. Linguistic determinants of stuttering

Linguistic aspects of stuttering form an important area of study and have presented a long research history. From the early works of Brown (1938, 1945), studies have investigated the loci and frequency of stuttered measures related to the phonetic, lexical, syntactic and pragmatic components of language. A psycho-linguistic approach in stuttering emphasizes on the concept of bottom-up model. This model allows spotting the features of stuttering in relationship with verbal disfluencies.

2.6.1. Phonological problems associated with stuttering

Based on several studies documenting the associated communication disorders in CWS, there is a evidence of articulation and phonological problems to be most frequent

(Andrews & Harris, 1964). According to Conture (1990), a disproportionately high number of CWS exhibit concomitant problems, especially phonological problems. Conture suggested that the "relationship between stuttering and disordered phonology involves a critical interaction between hyper vigilant self monitoring, a slow to activate phonetic plan, immature phonological encoding and/or motor execution system". Louko, Edwards and Conture (1990), Nippold (1990) and St. Louis and Hinzman (1988) observed that a disproportionately high number of CWS exhibit phonological problems, especially difficulty with consonants. A larger number and diversity of phonological processes and more atypical processes were exhibited by CWS. In the Indian context, Sneha et al. (2008) duplicated the similar findings in young CWS. The phonological processes included stopping, frication, multiple processes, lateralization, depalatalization, substitution of glide, epinthesis and change in place of articulation. Among these, stopping, frication and lateralization were deviant processes.

2.6.2. Phonetic determinants of stuttering

The linguistic theory of stuttering hypothesizes that the features of the word can increase the occurrence of disfluencies (Packman, Onslow, Richard & van Doorn, 1996). As early as 1938, Brown examined the influence of linguistic factors and then consequently several authors also researched on the same subject. From a phonetic point of view researches have focused on underlining the frequency of the speech difficulties in comparison with the phonemes uttered. The position of the instance of stuttering was confined to initial position. The phonological variety can influence speech fluency. The most frequent and the most familiar words are less difficult for PWS. The frequency in producing words function on the same level with phonological coding, aspect which can elucidate the difficulties specific for stuttering when syntactically complex structure are handled (Bock & Levelt, 1994). Few researchers have concluded that the grammatical form can be a predicting factor for stuttering (Watson, Byrd, & Carlo, 2011). The relation between linguistic complexity and the loci of stuttering, in the case of a linguistic structure has been established through a series of researches by few authors (Bernstein Ratner, 1981; Bock & Levelt, 1994; Sheehan, 1974; Curlee & Siegel, 1997). Johnson and Brown (1935) examined stuttering with respect to execution of various speech sounds.

AWS had increased disfluencies on consonants compared to vowels. In the year, 1945, Brown reported that stuttering was mostly noticed on consonants except /t/, /h/, /w/ and /ð/. On the similar lines Hahn (1942) observed a noticeable difference between the main categories of sounds. The author found less percentage of disfluencies for vowels (2.9%) compared to consonants . The consonants linked with highest amount of disflluencies were /g/, /d/, /t̪/, /l/ and /tʃ/. Interestingly, the order of sounds with difficulty can be well formulated for a group of PWS. However, the distribution of ranking with disfluencies differed from individual to individual. In addition, Hejna (1963) also concluded that the consonants were associated with greater stuttering. In the year 1955, Mann considered word lists and essays and indicated greater stuttering for consonants /s/, /v/, /m/, /l/ compared to other sounds. Soderberg (1962) performed a systematically controlled study by maintaining uniformity with respect to word frequency, accent, length, position and grammatical function. The author concluded no indication of differences in the occurrence of disfluencies on speech sounds. These findings ascertain significant interaction of more than one factor concerned with linguistic attributes. Taylor (1966) disagreed with Soderberg's findings and concluded that consonants were more disfluent except for sounds such as /t/, /h/, /w/ and /d/. The author interpreted the findings as increased disfluencies on plosives compared to continuants, although variability existed across the individuals with the consonantal contexts.

Several studies support the fact of presence of stuttering not only on consonant sounds but also on vowels. Hunt (1967) used the term vowel and consonantal stuttering. The vowels frequently stuttered were /u/, /o/ compared to the vowels /I/ and /e/. Among the consonants the explosive type of sounds were frequently stuttered compared to continuants. The reason put forth indicated that the sounds with explosive component involved complete closure of oral cavity in comparison with continuants.

The verbal imitations and reading of CWS were evaluated by Williams, Silverman, and Kools (1969). Fifty nine percent had increased disfluency on words that began with vowels and for the consonants /t/, /w/, /h/, /Ø/ but their results were not statistically significant. The voicing adjustments during the moments of stuttering were noted by Wall, Starkweather and Harris (1981). Stuttering was present notably on words for which voicing began after silence. During spontaneous utterances, the voicing attribute adjoining the disfluent phoneme also contributed to stuttering.

In the Indian context, the investigators addressed the issue with regard to linguistic attributes of stuttering. Geetha (1979) studied phonetic determinants in Kannada language in a wide age range of 5 to 20 years. The results were in consensus with earlier mentioned studies supporting greater disfluencies on consonants than vowels. The rank order with reference to the increased disfluencies was /a/, /k/, /m/, /n/, /h/ and /b/. On the other hand, Jayaram (1983) considered AWS for the analyses of phonetic influences in 10 monolingual and 10 bilinguals. The results revealed that nasals, voiceless fricatives and voiceless plosives were disfluent to a greater extent than others. Soumya and Sangeetha (2011) examined the phonetic influences in children with bilingualism. The findings offered a rank order for Kannada language as /tʃ/, /b/, /k/, /s/, /g/, /ʃ/, /r/, /m/, /j/, /n/, /ʈ/, /p/, /ɖ/, /h/, /v/, /ð/ and /l/. Also, the rank order of disfluency for short and long vowels were /e/, /a/, /o/, /i/, /u/ and /a:/, /ai/, /o:/, /au/ and /i:/ respectively.

The influence of phonetic factors on stuttering has also been examined by Throneburg, Yairi, and Paden (1994). They demonstrated less evidence of factors such as late emerging consonants during development (Sander, 1972), consonant strings and occurrence of multiple-syllables. On the contrary, Logan and Conture (1997) highlighted the trend of stuttered utterances with increased syllables than fluent utterances. Also, Howell, Au-Yeung, and Sackin (2000) found that children stuttered more on words that began with late emerging consonants. Dworzynski and Howell (2004) found that words ending in consonants had increased stuttering than vowels in German PWS. Similar outcome was noticed in both adults and children beyond the age of six. However, Howell and Au-Yeung (2007) demonstrated no such effects in English speakers. The findings of studies confirm the existence of phonetic attributes of stuttering, though certain variations exist.

According to Gestural Phonology Model of Browman and Goldstein (1990c), two consonants that present with identical place of articulation across a syllable require greater initiation time and greater programming effort as compared to producing the same two consonants (cluster) within a syllable. Comparable results were obtained by Huinck, Pascal, van Lieshout, Peters, and Hulstijn in a recent study (2004) evaluating the same. This increased demands on programming and timing is especially more pronounced in PWS. However, the authors do caution that the precise relationship between clusters and syllable boundaries is still hazy and further empirical evidence is critical before definitive conclusions are made.

Contrary to the findings of the above researchers, Sasisekaran and Byrd (2013) compared phoneme and rhyme monitoring response times between CWS and their fluent peers in the ages of 7 and 13 years. The results of their study failed to uncover any differences suggesting that the "processing and/or representation of holistic and segmental units in speech production are intact in CWS".

2.6.3. Phonetic environment of stuttering

Coarticulation is the influence of one phoneme on another (Sharf & Ohde, 1981; Whalen, 1990). Chang, Ohde, and Conture (2002) noted an acoustic evidence for abnormal coarticulation in preschool CWS. The authors hypothesized that if PWS exhibit disfluencies on a specific sound or syllable, it means that they do not have difficulty on that particular sound as it is produced accurately. The difficulty seems to be present in the intra or inter phonetic transitions. During the instance of transitional difficulty the phoneme succeeding the disfluent sound gains significance. Fletcher (1928) referred stuttering as an inability to connect the sound to the succeeding one. Like Bluemel (1930), even Wingate (1969) expressed that the stuttering moments on the consonants is majorly due to the difficulty while uttering the following sound which is almost consistently a vowel (or dipthong). Thus, he considers stuttering as an attempt of producing a stressed vowel. He noted the shaping movements that make a distinction from one vowel to another perhaps contribute to stuttering event. Kenyon (1943) also opined that PWS do not have any difficulty on consonants but the problem is with succeeding vowels. Stuttering represents an inability to connect one syllable to other adequately and rapidly. Crystal (1969) expressed that stuttering is not simply related to temporal aspects influencing fluency. Wingate (1969) indicated that sound/syllable repetitions and prolongations are universally defined features of stuttering and are described as breakdown in "phonetic transition". In this regard, the disfluencies are considered as individual's transient failure to get off one sound once it has been accomplished and make the transition to the next sound.

Dalton and Hardcastle (1977) used the term "transition smoothness" and regarded disfluencies as breakdown in "transition smoothness". Such breakdown may occur at the phonetic level, grammatical level and lexical/semantic level by the breakdown in the sequence of ideas. In an acoustic study, the spectrograms of part-word repetition were analyzed by Adams (1978) who suggested that the transitions ended abruptly. In addition, the faint striations indicated feeble and incomplete phonation for disfluent word. The acoustic evidence of Adams (1978) is supported by Perkins, Rudas, Johnson, and Bell (1976). They termed stuttering as discoordination with the subsystems of speech production. Gracco and Lofqvist (1994) examined the vertical and horizontal tongue body movements for voiced and voiceless velar stop in VCV sequences. It was noted that the duration, peak velocity and amplitude of the tongue body raising movement towards closure for the consonant was longer for the voiced stop which suggested a complex movement.

In the Indian context, Geetha (1979) investigated the effect of stuttering on different vowel (V) and consonant (C) combination. The syllables stuttered were classified into V, CV, VC, CVC and CCV. The results indicated that CV and V syllables had more stuttering compared to other syllable structures. The transitional hypothesis that stuttering is noticed as a transition from consonant to vowel was justified, although other syllable structures were limited. The phonetic environment in PWS according to place and manner of sounds was examined in 10 monolingual and 10 bilingual AWS by Jayaram (1983). He found that monolingual PWS (Kannada) showed a significant difference in the phonetic environment of stuttering while the normal group had no such difference. In Kannada language, vowels were more affected when sounds succeeded voiceless stops. Rest of the sounds were more affected when followed by short or long vowels, mostly long vowels. The significant finding was that while vowels were more often stuttered when the succeeding sounds were voiceless sounds, consonants were stuttered more when they were followed by long vowels. Similar findings were observed for stuttering even in English language, in both reading and spontaneous speech tasks. The trend was markedly noticed in English language, in the sense that stuttered consonants were always followed by voiced sounds. The likely explanations put forth are as follows. A disturbance might be present with regard to initiation of voice and faulty anticipatory coarticulation. The initiation of vocalization is a fundamental element in stuttering and that continuous transition from voiceless to voiced sounds or vice versa might lead to disfluency (Starkweather, Hirschent, & Tannebaum, 1976).

The sequencing of articulators (upper lip (UL), lower lip (LL), and jaw peak (JA) velocity and movement onset) during the production of bilabial consonants in various phonetic environments in PWS and PWNS were examined by De Nil (1995). The results were unsuccessful in supporting the earlier findings of invariance in the pattern of articulatory sequencing observed among PWNS. The sequencing pattern tended to be influenced by both the specific bilabial consonant (/p/ or /m/) and also the context in which they were produced. Although significant differences in peak velocity were noticed between the groups, the pattern of sequencing remained more typical in the non-clinical group. AWS have reduced refinement in articulation of individual speech segment due to "greater or quicker movement of the tongue body in transitioning from closing to opening to closing vocal tract gestures" (Robb & Blomgren, 1996). It was noted that CWS exhibited either slower motor execution or longer central processing or both before execution (Postma & Kolk, 1993).

Anticipatory coarticulation and formant transition rate (FTR) of speech production in 14 young CWS and 14 children with no stuttering (CWNS) were examined by Chang et al. (2002). Their findings indicated a significant difference in FTR, especially with regard to place of articulation for CWNS than for CWS. They suggested that the organization of the FTR for place of articulation may not be well developed in CWS. Such a slight transitional difficulty may contribute to the disturbance in fluency.

The influence of phonological neighbourhood density on a reaction time task (Speech Reaction Time, SRT and Accuracy) of CWS and CWNS during a picture-naming task were examined by Arnold, Conture, and Ohde (2005). The analyses revealed that both groups performed significantly better (reduced SRTs and greater accuracy) on phonologically sparse than dense words. Similar findings in both the groups were found for the picture-naming task and not for spontaneous speech task. Corbera, Corral, Escera, and Idiazábal (2005) found normal MMN potentials in response to simple tone contrasts while a noteworthy supratemporal left-lateralized enhancement of this potential was noted in response to phonetic contrasts. The authors postulated that this abnormal speech sound representation may be the underlying cause of their fluency disorder.

Stuttering generally tends to occur on the initial position of words and utterances. The reason put forth is attributed to "anticipatory priming”. The first activating node simultaneously primes further nodes in a word and the priming of last node constitutes "anticipatory priming". Stromsta (1986) concluded that deficient anticipatory coarticulation is probably the primary element in the core behaviour of stuttering and a disruption among the subsystems of speech has surprisingly been noted for both stuttered and fluent productions. As noted by Cooper and Allen (1977) PWS presented difficulty or less stability during a sequencing task compared to normals. The authors explained this phenomenon as reduced accuracy with the control of timing.

The units of speech are categorized as individual attributes of articulatory features as proposed by Henke (1967). According to Mac Neilage (1970), commands are predetermined in the nervous system regarding the speech motor output which possibly may or may not be associated with linguistic units. However, the attributes of language such as prosody, rate, and the context also play a major role during speech production (Dalton & Hardcastle, 1977). Suchitra (1985) found that the fluent utterances of PWS manifested number of coarticulatory transitional differences (duration of F2 transition) compared to normals. It indicated that the articulatory configurations required for production of a phoneme was not fully achieved in PWS. Yaruss and Conture (1993) concluded that PWS exhibit a spatial/temporal disco-ordination of fine articulatory movements necessary to produce a clear, smooth and rapid speech. Studies (Zmarich & Marchiori, 2006) found the coarticulation processes in PWS that indicated quicker and exaggerated action of the tongue as it moved from consonant to vowel target. It is also stated that "during the disfluencies that characterize stuttering, the speech motor system fails to generate and/or send the motor commands to muscles that are necessary for fluent speech to continue" (Olander, Smith, & Zelaznik, 2010).

To summarize the literature on phonetic determinants of stuttering, an extensive research has revealed disco-ordination of phonation with articulation and respiration. Investigators also described breakdown in phonetic transition in PWS. The findings suggested increased disfluencies with greater involvement of speech muscles. Particularly, PWS tend to be most disfluent in spontaneous speech task. Though the studies highlight the break down within the speech muscles, stuttering would also include the contribution of higher level processes. Such factors include anxiety and sentence complexity which may increase the occurrence of disfluencies (Pellowski & Conture, 2005).

2.6.4. Morphological determinants of stuttering

Individuals who stutter do not exhibit disfluencies on every single utterance they produce. Investigators have demonstrated that the occurrence of disfluencies depend on the linguistic features of the word produced. Several authors have conducted investigations examining the influence of word position (Natke, Sandrieser, van Ark, Pietrowsky, & Kalveram, 2004), word class (Howell, Au-Yeung & Sackin, 1999), phoneme composition of a word (Howell, Au-Yeung & Sackin, 2000), word density (Hubbard & Prins, 1994), and context (Silverman & Bernstein Ratner, 2002) on the frequency of occurrence of disfluencies.

2.6.4.1. Word position and instances of stuttering

Several studies in the literature have revealed the relationship between disfluencies and word position in a sentence. Increased disfluencies were observed on the initial word, less on the second word and even lesser on the third word of an utterance (Brown, 1945). A partial support was evidenced by Hejna (1963) for the position gradation effect in the spontaneous speech of CWS. Greater than expected levels of stuttering were observed on the 2nd, 3rd, 4^{tb}, 6th and 7th word positions. 1st and the 5th word positions were not found to differ significantly from expected frequencies. The failure to locate increased stuttering on the 1st word was explained to be due to the fact that in spontaneous speech, the initial word was often a starter word as 'well', 'and' which convey little meaning.

Supporting Brown’s study, Quarrington, Conway, and Siegel (1962) found more stuttering on the initial words. Conway and Quarrington (1963) controlled the variables such as initial phonetic sound, grammatical class and number of syllables for a reading task in the experiment. It was found that the initial words were more susceptible to stuttering than medial and medial more than final position of words in the sentence. Quarrington (1965) found a correlation of 0.49 between position of the word within the sentences and decreasing frequency of stuttering and unpredictable words were more likely to be stuttered. Taylor (1966) opined that neither length nor phonemic attributes of a word were as important in predicting the instances of disfluencies as position of the word in the utterance.

A similar finding was reproduced by Soderberg (1967) who also reported greater disfluencies on the first word in an utterance than on subsequent words even though initial words were more typically the function words while final words were more often the lexical class. Bloodstein and Gantwerk (1967) and others (Bernstein Ratner, 1981; Curlee, 1985; Griggs & Still, 1979; Siegel, 2000; Silverman & Williams, 1967) also found that very young CWS had more trouble on the first words of their utterances or near the beginning of a sentence. Commenting about the position, Wingate (1979) concluded that increased disfluencies occurred on the initial three words of an utterance. The effect of word density was more pronounced on shorter words as compared to longer ones. Natke, Sandrieser, van Ark, Pietrowsky, and Kalveram (2004) demonstrated that the disfluencies tended to occur 97.8% of the time on the initial syllables and approximately 76.5% on the initial phoneme of the syllable indicating a prominent word position effect.

A review on occurrence of stuttering confirmed the effect of position of the word in sentence. Studies relating the occurrence of disfluencies to the initial position of a phrase agreed with psycholinguistic studies that suggested other normal disfluencies also tended to occur on the same position (Boomer, 1965; Holmes, 1988). The reason offered for such findings point to an indecisive linguistic planning. As per Bosshardt (1995) speakers plan their utterances earlier than actual production leading to processing costs which is linked to overloading the resources on hand for effortless speech production. Similarly, studies examining stuttering in childhood have made a noteworthy mention of grammatical elements of a sentence (Bernstein, 1981; Wall, Starkweather, & Cairns, 1981) and speech motor production (Bloodstein & Grossman, 1981; Logan & LaSalle, 1999) as being the major factors influencing the occurrence of disfluencies. According to Glover (2004) planning involves the assimilation of various means of information associated with greater propositionality, and hence is more demanding and complicated.

In addition, Au-Yeung, Howell, and Pilgrim (1998) also addressed the position of the stuttering as predominantly initial in a sentence for the group of function words. As such, they found that the influence of utterance position on stuttering becomes less distinct as children get older, consistent with previous findings (e.g.,Williams et al., 1969). Two points can be noted from the work of Howell et al. (2000), "First, the tendency to stutter on initial function words within phonological words appears to be consistent with findings that stuttering tends to take place at the beginning of a sentence. In other words, speech disfluencies may emerge due to difficulties or inefficiencies associated with the planning of linguistic units, whether they are syntactic units or phonological word or supra segmental units" (Bernstein Ratner, 1997).

2.6.4.2. Word class and stuttering

Researchers speculated a specific set of word class to be stuttered across age groups. The major class of words that presented with a greater probability of being disfluent included content words, words of increasing length, words at the initial positions in a sentence, and words beginning with a consonant (Brown, 1945). Function words can be described as those belonging to the category of closed set of words solely pertaining to syntactic completeness. These include pronouns, articles, prepositions, conjunctions and auxiliary verbs. These words tend to be short and are employed on a regular basis. Content words, on the other hand, are independent, meaningful lexical units, belonging to the category of open set of words. These are comprised of nouns, main verbs, adverbs, and adjectives (Kucera & Francis, 1967; Landau & Jackendoff, 1993; Quirk, Greenbaum, Leech & Svartvik, 1985). In contrast to Brown's (1945) study on AWS, Bloodstein and Grossman (1981) noted that CWS tended to exhibit greater disfluencies on function compared to content words. In specific, Lima (2002) found that CWS exhibited a higher occurrence of SLDs on articles (function word) in Portugese language. Articles in Portuguese are single syllabic markers that determine aspects of gender and number for the succeeding noun (e.g. “a menina” – the girl; “as meninas” – the girls).

The essential similarity of the loci of disfluencies was demonstrated by Silverman and Williams (1967). Their results indicated that disfluencies in the speech of normals and PWS were not randomly distributed. Content words, long words, and words that began with consonants were mostly disfluent. More disfluencies were found on conjunctions and pronouns in a 3 years old child with stuttering as described by Meyers, Ghatak, and Woodford (1989). A study by Juste, Sassi, and De Andrade (2012) found higher occurrence of SLDs on verbs (content word) in Portugese CWS. The verb category is acquired later in language development, has wider meanings, more complex syntactically and morphologically when compared with other content word categories (Bates, Chen, Tzeng, Li, & Opie, 1991; Berndt, Mitchum, Haendiges, & Sandson, 1997; Bi, Han, Shu, & Caramazza, 2005; Honincthun & Pillon, 2005). In addition, Samadi (2001) reported that Persian CWS aged 6–10 years were more disfluent on content words.

The relationship between the utterance length, MLU of words and instances of disfluencies in children were analyzed by Brundage and Bernstein Ratner (1989). The results revealed that increase in length and number of words was associated with disfluencies. Investigations were conducted to understand the relationship involving the linguistic characteristics and moments of disfluencies across age groups. Au-Yeung et al. (1998) considered young children to adults in a cross-sectional study. Younger children exhibited greater number of disfluencies on function words. The older participants exhibited more disfluencies on content words. The authors emphasized a kind of switch over of the disfluencies from function to other class of words with increase in age. The authors also demonstrated that function words that preceded the content ones involved more disfluencies in comparison with the words that succeeded the content words.

The probable reason for the occurrence of stuttering on different word class is explained by Howell, Au-Yeung, and Sackin (1999). They have explained that the probable reason for the occurrence of stuttering on function words could be a kind of delaying strategy used as the planning for content words are incomplete. Hence, the authors emphasized on the presence of disfluencies among function words because of external factors. A developmental trend has been observed with regard to the word class suggesting presence of disfluencies among content words with increasing age. Such a difficulty is observed while producing the content words which are not completely planned. It is striking to observe the switch over of the word category that involves a coping strategy to deal with disfluencies with increasing age.

A study was conducted on 35 German CWS in the age range of 2 – 11 years (3 age groups) by Dworzynski, Howell, Au-Yeung, and Rommel (2004). German language seems to be complex than English as it consists of lengthier nouns. Their findings evidenced elevated number of disfluencies for function words positioned in beginning of phonological word noted in young children. They also found that more stuttering was associated with function words that occurred prior to content words. In addition, the stuttering rate on word class presented an exchange from function to content words with increase of age in children. These findings are interpreted based on the assumption of EXPLAN model (Howell & Au- Yeung, 2002). It assumes that type of word categories function in the similar manner among the languages (Howell & Dworzynski, 2005).

Dayalu, Kalinowski, Stuart, Holbert, and Rastatter (2002) reiterated that while considering English language, content words are majorly disfluent than the other set of words. It is apparent that the content words have multifaceted attributes such as complex phoneme composition (Howell et al., 2000), occurs less frequently (Quirk & Stein, 1990) and contain stress components (Wingate, 1984). The reduced disfluency rate on function words was explained with reference to adaptation effect. During speaking task the frequency of usage of function words are more in number, usually or regularly used and hence involves a generalized adaptation effect. In support of these findings, Bard and Anderson (1983) delineated that function words are comparatively less stressed, have flatter fundamental frequency contour and with lesser vowel shifts than content words.

Natke, Sandrieser, van Ark, Pietrowsky, and Kalveram (2004) investigated the link between stuttering and linguistic stress in 22 young children. Syllable stress were analyzed and regarded as short, long stressed, no stress, and intermediately stressed. The authors observed increased disfluencies on function words (16.9%), especially on the beginning syllables. On similar lines, Juste (2006) analysed disfluencies in CWS and CWNS in the age ranges between 4.0 and 11.11 years in Brazilian Portuguese language, mainly for the articles. Their result agrees with findings of the other researchers (Graham, Conture, & Camarata, 2004; Howell et al., 1999; Richels, Buhr, Conture & Ntourou, 2010).

A recent study by Vahab, Zandiyan, Falahi, and Howell (2013) considered a third group of word class, content–function words. They explored the effect of disfluencies for various word categories in 12 CWS in the age range 7 to 11 years for narrative and reading samples. They found increased stuttering rate for content and content–function word categories in comparison with function words. The function and content word distinction has also been investigated in an EEG study with individuals who stutter (Weber-Fox, 2001). Her results indicated that the event-related potentials (ERPs) of people who stutter were characterized by reduced negative amplitudes for closed-class words, open-class words, and semantic anomalies in a temporal window of approximately 200–400 ms after word onsets. These results are suggestive of reduced cortical representation with a possibility of weaker working memory for the lexicon.

2.6.4.3. Word frequency and stuttering

Word frequency is said to be closely related to the aspect of word length in stuttering. Research concerning effects of word length and word frequency on stuttering has not demonstrated thoroughly the independence of these variables in their relationship to stuttered speech (Brown & Moren, 1942; Hejna, 1963; Schlesinger, Forte, Fried, & Melkman, 1965). As per Zipf’s (1949) rule on the frequency of occurrence of words, longer words tend to be less frequent in language than shorter ones. Soderberg (1966) found both factors (length and frequency) to be important determiners but word frequency to be the less important of the two. Dayalu, Kalinowski, Stuart, Holbert, and Rastatter (2002) have remarked about the frequency of words stating that words that occur less frequently present more disfluencies than words that occur most frequently. In addition other studies (Hubbard & Prins, 1994; Prins, Main, & Wampler, 1997) also reported similar findings.

Anderson and Byrd (2008) examined the effect of frequency of occurrence of sound segments for speaking task in 19 preschool CWS. It was observed that the effect of occurrence of sound segments did not play a significant role on disfluencies. Moreover, repetitions of monosyllabic words were significantly reduced for such segments compared to repetitions of word and prolongations. Hence, the authors interpreted findings to support the viewpoint of disfluencies to occur due to breakdown at various stages of processing. In agreement with these findings, Bernstein Ratner, Newman, and Strekas (2009) also noted no significant differences in naming accuracy between the PWS and normal groups while considering the effect of frequency of words. They suggested that the disparities between the groups may not be related to arrangements of sound segments in the linguistic units.

2.6.4.4. Word length and stuttering

Longer utterances are related to motoric and linguistic planning. Logan and LaSalle (1999) examined few features of disfluencies among 14 CWS and 14 CWNS. For CWS, utterances with disfluency clusters consisted of increased number of syllables and clausal constituents. In both CWS and normal utterances with disfluency clusters were associated with the clause onset than grammatical constituents. Normal children presented marked increase in grammatical revision with utterances. The findings can be interpreted as the presence of disfluency clusters relating to complicated linguistic constituents.

Chon, Sawyer, and Ambrose (2012) investigated utterances containing fluent, ODs and SLDs in 14 young CWS. They noted the feature of increased length in utterances containing ODs and SLDs which revealed greater amount of motoric and linguistic struggle. The authors claimed increased demand on speech motor control due to extensive linguistic features. Similarly, a study considering naming latencies conducted in 30 normal adult speakers by Santiago, MacKay, Palma, and Rho (2000). They found longer reaction time for two-syllable words and for words that began with consonant clusters.

Further, Roelofs (2002a) indicated that the reaction time for cluster utterances are positively correlated with word length. As the task becomes more complex in nature, undue stress is placed on a fragile speech motor system, requiring supplements from an already limited set of central resources. This additional stress may result in an less stabilized speech motor system and hence greater stuttering (Smits-Bandstra & De Nil, 2007; Van Lieshout & Goldstein, 2008).

2.6.4.5. Studies on combination of morphological determinants and stuttering

Researchers have studied the combination of morphological determinants during the instances of stuttering. In general each stuttered word is analyzed in regard to word class, length of an utterance, word usage and context. Watson, Byrd, and Carlo (2011) studied the role of word length, grammatical difficulty, and accuracy on the presence of disfluencies in a speech task of Spanish CWS between the ages of 2.9 and 5.8 years. Their results indicated that the likelihood of disfluencies increased when utterances were longer and syntactically more complicated. In other words, word length and syntactic accuracy were the key indicators of disfluencies in CWS (Rommel, Ha¨ ge, Johannsen, & Schulze, 1997; Rommel, Ha¨ge, Kalehne, & Johannsen, 2000).

A recent study by Al-tamimi, Khamaiseh, and Howell (2013) investigated the relation between the index of phonetic complexity (IPC; Jakielshi, 1998) and the frequency of disfluencies in Jordanian Arabic speakers. Based on age, speakers within the ages of 6 to 18 years were categorized into 3 groups with 4 year age intervals. Arabic Index of Phonetic Complexity was utilized to score every spoken utterance. Greater AIPC score suggested greater likelihood of disfluencies. Phonetic features that significantly influenced the disfluencies included place and manner of articulation, length and shape of the utterance identical to any other language. Additionally, AIPC scores did not correlate well with the category of function words, and a contrary trend was noted for the category of content and function-content words.

The developmental stuttering is related to “one or more temporal misalignments in the processes that underlie speech and language production” (Conture, 2001). These specifically relate to temporal misalignments between lexical retrieval and morpho-syntactic structures. According to Kolk and Postma (1997) other factors such as the “rate at which words, syllables or speech sounds become activated for selection (CRH) and the rate at which a person tries to initiate and/or produce speech also seem to play an important role on stuttering behaviours”. Anderson (2008) obtained marginally significant differences in a priming task for CWS. These findings seemed to indicate weaker connections between the various linguistic representations of a word in the lexicons of CWS. Further, the kinematic studies have demonstrated that the neural activity of PWS varied with those of their peers, even in instances of normal fluency implying disturbances between the linguistic, motoric and temporal aspects of speech production (Foundas, Bollich, Feldman, Corey, Hurley, Lemen, & Heilman, 2004; Fox, Ingham, Ingham, Zamarripa, Xiong, & Lancaster, 2000; Smith, Sadagopan, Walsh, & Weber-Fox , 2009; Watkins, Smith, Davis, & Howell, 2008).

To summarize, several investigations have arrived at similar conclusions stating that lengthier and more complicated utterances tend to be more disfluent. It was also noted that most stuttering occurs on first syllables in a word and the first sound in a syllable. This was assumed to be associated with an excessive taxation of resources available for linguistic processing and such undue stress on an already susceptible speech motor system such as seen in PWS, would lead to further breakdowns in fluency (Bosshardt, 2006). These assumptions provide support to psycholinguistic theories which state that disfluencies are a result of conflict at multiple levels of linguistic encoding. Although stuttering is a multifaceted disorder, we are yet uncertain as to which among these play an operative role and which are epiphenomenal.

2.6.5. Syntactic determinants of stuttering

2.6.5.1. Position of instances of stuttering in a sentence

Linguistic attributes and moments of disfluencies are investigated by several authors at both word and sentence level. As noted by Brown (1938) the moments of stuttering occurred at the beginning of the sentence, on word categories such as nouns and verbs most of the time. The finding that the instances of stuttering are expected at the start of a sentence was constant in majority of studies related to stuttering and linguistic investigations. The disfluencies termed as "typical" in normal individuals also seems to occur at the start of a sentence (e.g., Boomer, 1965; Holmes, 1988). Such findings are interpreted as of "greater significance effect" are present especially at the beginning of the sentence during communication task (Quarrington, 1965; Trotter, 1956). It also indicated that PWS are not certain while constructing the sentence which might lead to disfluencies (e.g., Soderberg, 1967). The occurrence of disfluencies at initial position lends support to the breakdown in planning the utterance indicating disturbances in integrating sentence constituents (Bernstein, 1981) or motor initiation/execution (Bloodstein & Grossman, 1981). The timing aspects of planning have been investigated in persistent developmental stuttering by Sommer, Koch, Paulus, Weiller, and Buchel (2002). The authors speculated disturbances in activation in motor speech area of brain specifically with regard to temporal measure of activation.

Buhr and Zebrowski (2009) conducted longitudinal study to determine the measures of disfluencies in 12 preschool children between 36 and 71 months of age. The authors confirmed the consistency of position of stuttering in a sentence initial level. In addition, the function words were disfluent only in the beginning position indicating an evident pattern. This is contrasted with a study by Bloodstein (1974) who noted an association between the loci of stuttering and the essential structure of a sentence in CWS (3 to 6 years). Based on the results, the author concluded that the disfluencies in young children were not affected directly by factors such as beginning sound, length of utterance or frequency of utterance.

2.6.5.2. Sentence length and complexity on stuttering

Linguistic contributions to stuttering have been measured considering sentences. Several studies found consistent findings in terms of occurrence of increased disfluencies. The findings favoured greater disfluencies on sentences constituting more words and complicated sentence structure (Gaines, Runyan, & Meyers, 1991; Zackheim & Conture, 2003). In addition, investigators (Bernstein Ratner & Sih, 1987; Rispoli & Hadley, 2001) also observed occurrence of typical disfluencies on sentences with complex structure.

Muma (1971) explained an association involving the language ability in children and disfluencies. He hypothesized that stuttering occurs in disfluent children as they try to utilize complex syntactic elements in their conversational repertoire. Therefore, in an attempt to evade these disfluencies, CWS generally tend to use simpler and less complex utterances. This study indicated that a non-loci explanation of disfluency should be cast in terms of the nature of transformational operations in grammatical performance.

A study by Tornick and Bloodstein (1976) considered 20 pairs of sentences with one set of short sentences and the other set of long sentences. The initial segments of each of the long sentences constituted the short sentences. Only those words which were shared by both the long and short sentences were analyzed. Lengthier utterances exhibited more disfluencies as compared to short ones, although they contained the same phrases. These findings highlight the contribution of anticipatory motor planning for complex utterances. The increased stuttering was believed to be caused by perception or preparation for, the greater length of the long sentences. This relates to some significance to either anticipatory struggle or breakdown views of stuttering.

More stuttering was observed by Wall, Starkweather, & Cairns (1981) at clause junctures, conjunctions and at the start of sentences in 9 male CWS in the age range of 4:0–6:6 years. Significantly greater stuttering was noted on lengthier utterances in young group of CWS (3:11–6:4 years) for imitation task according to Bernstein Ratner and Sih (1987). Gaines et al. (1991) noted the presence of greater disfluencies on the initial three words of an utterance, especially when these utterances were long and complicated. Gordon (1991) used sentence repetition and modeling tasks among CWS and CWNS in the age range of 3:7–7:11 years. For both groups of children, reduced stuttering was reported for the repetition task as compared to the modelling task, suggesting influence of age of CWS and the task on the occurrence of disfluencies. In contrary, Wall et al. (1981) commented that these findings related to sentence length and complexity should not be taken to suggest that these would necessarily exert a causal influence on disfluency. Instead, each of these factors may contribute to some demand connected to planning the sentence.

The findings of a longitudinal study by Colburn and Mysak (1982) illustrated that CWS showed variability in the patterns and rate of disfluencies for varied mean length of utterances. Interestingly, a high degree of relationship emerged between childhood stuttering and syntactical constructions. In addition, Weiss and Zebrowski (1992) noted that declaratives tended to be more disfluent as against responsive utterances, only when they were longer. In the same vein, Bernstein Ratner and Sih (1987) examined the influence of MLU and syntactic complexity on disfluencies in CWS and CWNS between the ages of 3.11 and 6.4 years on an imitation task. Their results attributed greater disfluencies to more complicated sentence structures. Their findings also suggest that fluency breakdown is significantly well associated with gradual increase in syntactic complexity for both the groups, as in sentence replication ability. Younger group of CWS produced increased disfluencies even on less complex grammatical structures suggesting variations across age (Kadi-Hanifi & Howell, 1992). Overall, disfluencies were more predominant on lengthier and more complicated utterances despite the type of sentence (Melnick & Conture, 2000; Yaruss, 1999). Howell and Au-Yeung (1995) found a marked difference to exist between young CWS and CWNS with regard to their usage of grammatical structures, which declined as age progressed. Logan and LaSalle (1997) analyzed fluent and disfluent utterances of CWS in the age range of 36–66 months. Their results reflected a relationship between clausal constituents of an utterance and the occurrence of disfluencies. In conditions when the number of clausal constituents in an utterance was altered, CWNS tended to cope with these alterations by revising their formulations, while their nonfluent counterparts did not utilize such coping mechanisms. Therefore, CWS exhibited greater disfluencies with the usage of more clausal constituents.

Hannah and Gardner (1968) examined the location of stuttering within the spontaneous speech sample of adults. They found that stuttering occurred more often in the post-verbal than pre-verbal or verbal units within the sentence. The post-verbal unit might contain a noun phrase or an expansion such as a relative clause. Further analysis revealed that although not all expansions of the post-verbal unit correlated significantly with stuttering rate, when the expansion was a coordinate or embedded clause; a significant positive relationship was obtained. The authors reported of no correlations between stuttering and subject, verb, and object/complement/optional adjunct. They concluded that stuttering was more often associated with syntactic position than syntactic complexity. Wells (1979) detected significantly more stuttering in sentences with multiple embedded clauses than those with a single embedded clause in spontaneous speech of adults. Further, boundary events were examined by Bernstein (1981) at the onset of the noun and verb phrases in preschool CWS. The author found that the "Verb phrase attracted a significantly high degree of disfluencies for young CWS". It was accounted to an agreement imposed by the noun that preceded verb, planning semantic relations and to produce a sentence as a whole. Ahangar, Bakhtiar, Mohammadi, and Kavaki (2013) examined the relation between the syntactic complexity and moments of stuttering in 15 preschool children in Persia. Their findings revealed significant differences between fluent and stuttered words in terms of syntactic complexity of noun and verb phrase structures. In addition, at noun phrasal level there was a meaningful relationship between the number of subject and object of preposition with the stuttering frequency, while at verb phrasal level there was a meaningful relationship between the presence of the auxiliary verb and the stuttering frequency.

According to Yaruss (1999), stuttering was found to occur on sentences that contained either negatives, a high valence of the main verb, or an interrogative. Logan (2001) observed significantly reduced disfluencies on the production of a prepared set of sentences than during a spontaneous speech task. Additionally, PWS produced the prepared sentences at a faster rate when it was syntactically more complex. The effect of sentence length and complexity with respect to MLU was examined in 6 CWS by Zackheim and Conture (2003). The results indicated that stuttering was more prone to occur when children attempted utterances that were lengthier and more complicated than their habitual MLU. These findings appear to lend credit to the supposition that length, complexity and the knowledge of language use significantly contribute to the occurrence of stuttering. This mismatch between the rapidly learnt linguistic attributes and the gradually maturing linguistic system seem to contribute to the disfluencies in an utterance.

Rate of speech, sentence length, and syntactic complexity was determined in 14 CWS and CWNS by Sawyer, Chon, and Ambrose (2008) at varied points of time. They explored the interaction of the variables at the initial portion (syllables 1–300, Section A) and concluding portions (syllables 901–1200, Section B) of the spoken sample. Sentence length witnessed a significant growth in the latter portion of the sample (Section B) while rate of speech and syntactic complexity remained relatively the same across both portions (Sections A and B). Variables like MLU and syntactic complexity contribute to the occurrence of disfluencies in both groups of children. Bauerly and Gottwald (2009) noted that when group comparisons were made for 6 preschool CWS, complexity varied across fluent and nonfluent utterances. However, this difference was not significant at constant lengths of utterances. Furthermore, these differences in complexity were more evident only with greater syntactic development. Therefore, as a child's syntactic treasury expands, less complex sentences become more fluent while recently attained utterances remain disfluent. The essence of these results seem to imply that frequency of disfluencies vary across a "developmental continuum", with stuttering occurring most often on novel grammatical forms. In a recent study, Tsiamtsiouris and Cairns (2013) addressed the issue of increased processing demands for utterances that were highly complicated in AWS. They noted that AWS had reduced speech initiation latencies and were more disfluent in the production of sentences with high structural complexity.

Majority of the studies have illustrated that greater utterance length and/or complexity are linked with greater instances of disfluencies in both CWS and CWNS, with several investigations revealing interaction effects between these two variables. However, certain studies have predicted complexity to be the more contributing variable while others have noted length to play a significant role on disfluency. However, caution must be exercised while drawing conclusions from these findings, in that sentence length and complexity should not be taken to suggest that these alone are the causal factors for disfluency.

To summarize the review of literature regarding the linguistic determinants of stuttering, there are enormous numbers of studies related to it. The relationship between various linguistic factors and stuttering has been examined from the early 1940s by Brown (1938, 1945) and then by several others after him. Linguistic aspects of stuttering form an important discipline and have presented a long research history. From the early works, studies have investigated the language abilities of CWS, loci and frequency of stuttered events related to the phonetic, lexical, syntactic and pragmatic components of language. The literature on language abilities in CWS reveal mixed results. Majority of the studies support the presence of imbalance among the components in speech language systems in preschool CWS. However, certain other studies provide no empirical evidence to the assumption that CWS exhibit a language deficit compared to their fluent peers. The relationship between stuttering and bilingualism also pose to be mysterious. From the various studies done, it can be seen that there is disparity in the findings reported in the studies of bilingual CWS.

METHOD

The current study was aimed to analyze the patterns of disfluencies, language abilities and linguistic variability in monolingual (ML) and bilingual (BL) CWS in the age range of 6-8 years. The detailed method adopted for the same is provided below.

3.1. Participants

A total of 120 participants in the age range of 6-8 years (ML mean age - 7.29; BL mean age- 7.32) comprising of 4 groups (2 clinical & 2 control groups) were considered in the present study after eliminating around 10 children who did not fulfil the inclusion criteria for the study. Tables 3.1 and 3.2 displays the demographic details of ML and BL CWS considered in the study. Group 1 included 35 ML CWS having Kannada as their mother tongue and studying in a Kannada medium schools. Group 2 included 25 sequential BL CWS with Kannada (L1) as their primary language and studying in English medium schools and exposed to English (L2) for more than two years. Sequential bilinguals learn their primary language initially, and then learn the second language (De Houwer, 1995). Group 3 and 4 included age and gender matched ML and BL normal children respectively. The clinical group was selected based on the inclusionary criteria of being diagnosed as having developmental stuttering, native Kannada speakers, studying in Kannada medium schools (for the ML group) or English medium (for BL group) and not having any history of hearing, neurological, visual, language and /or psychological impairments. The normal group consisted of participants with no history of speech-language problems, sensory, motor or cognitive problems which was ruled out using the "WHO ten question disability screening checklist" (Singhi, Kumar, Malhi & Kumar, 2007). The participants in the clinical group considered in the study were registered clients in speech and hearing centres in and around Mysore. In addition, the data sample also included the government schools in different areas of Mysore.

Table 3.1
Demographic profile of ML CWS

Participants	Age (years & months)	Gender	Age of onset (years)	SES	SSI Score	SSI severity
P 1	7.2	M	2-3	Mid	29	Sev
P 2	6.5	M	2-3	Low	35	Sev
P 3	7.9	F	3-4	Low	34	Sev
P 4	7.9	M	4-5	Low	31	Sev
P 5	7.4	M	2-3	Mid	31	Sev
P 6	6.5	M	2-3	Mid	28	Sev
P 7	7.9	M	3-4	Low	30	Sev
P 8	6.5	M	2-3	Mid	30	Sev
P 9	7.4	M	2-3	Mid	27	Mod
P 10	6.5	F	4-5	Mid	27	Mod
P 11	7.4	M	3-4	Low	26	Mod
P 12	7.8	M	3-4	Low	24	Mod
P 13	7.8	F	2-3	Mid	25	Mod
P 14	7.9	M	3-4	Low	23	Mod
P 15	7.5	M	3-4	Low	23	Mod
P 16	7.8	M	2-3	Low	23	Mod
P 17	7.5	M	4-5	Mid	21	Mod
P 18	7.5	M	2-3	Low	24	Mod
P 19	6.3	F	3-4	Mid	26	Mod
P 20	6.8	F	2-3	Mid	25	Mod
P 21	6.6	M	3-4	Mid	24	Mod
P 22	6.3	F	3-4	Low	21	Mod
P 23	6.4	M	3-4	Mid	21	Mod
P 24	7.8	M	3-4	Mid	25	Mod
P 25	7.6	F	3-4	Mid	27	Mod
P 26	7.6	M	2-3	Low	22	Mod
P 27	7.4	M	2-3	Mid	24	Mod
P 28	7.4	M	4-5	Low	27	Mod
P 29	7.9	M	2-3	Low	24	Mod
P 30	7.9	M	2-3	Mid	27	Mod
P 31	7.6	M	4-5	Low	26	Mod
P 32	6.5	M	4-5	Mid	26	Mod
P 33	7.3	M	3-4	Mid	26	Mod
P 34	7.9	M	4-5	Low	24	Mod
P 35	7.10	F	4-5	Low	24	Mod

Note. SES = socioeconomic status, SSI = stuttering severity instrument, Mod = moderate, Sev = severe.

Table 3.2
Demographic profile of BL CWS

Participants	Age (years & months)	Gender	Age of Onset (years)	SES	Severity of stuttering			
					K SSI	K SSI Sev	E SSI	E SSI Sev
P 1	7.10	M	2-3	Mid	27	Mod	29	Sev
P 2	7.10	M	2-3	Mid	25	Mod	25	Mod
P 3	7.8	M	4-5	Mid	24	Mod	24	Mod
P 4	7.10	M	2-3	Mid	31	Sev	31	Sev
P 5	6.6	M	3-4	Mid	24	Mod	24	Mod
P 6	7.10	M	3-4	Mid	26	Mod	26	Mod
P 7	7.3	M	2-3	Mid	29	Sev	29	Sev
P 8	7.5	F	4-5	Mid	35	Sev	35	Sev
P 9	7.8	M	2-3	Mid	31	Sev	33	Sev
P 10	7.8	M	2-3	Mid	32	Sev	30	Sev
P 11	7.10	M	3-4	Mid	28	Sev	26	Mod
P 12	7.9	F	4-5	Mid	27	Mod	27	Mod
P 13	7.10	M	4-5	Mid	27	Mod	29	Sev
P 14	7.6	M	3-4	Mid	20	Mild	22	Mod
P 15	7.6	M	4-5	Mid	24	Mod	24	Mod
P 16	7.8	M	3-4	Mid	22	Mod	24	Mod
P 17	7.4	M	3-4	Mid	27	Mod	27	Mod
P 18	7.8	M	3-4	Mid	24	Mod	24	Mod
P 19	7.10	M	4-5	Mid	27	Mod	25	Mod
P 20	6.4	M	2-3	Mid	27	Mod	27	Mod
P 21	7.5	F	3-4	Mid	30	Sev	30	Sev
P 22	7.10	M	3-4	Mid	20	Mild	22	Mod
P 23	7.10	F	2-3	Mid	29	Sev	29	Sev
P 24	6.4	F	3-4	Mid	21	Mod	23	Mod
P 25	7.9	M	4-5	Mid	22	Mod	22	Mod

Note. SES = socioeconomic status, Mod = moderate, Sev = severe, KSSI = SSI Score in Kannada, KSSI Sev = severity in Kannada based on stuttering severity instrument, ESSI = SSI Score in English, ESSI Sev = severity in English based on stuttering severity instrument.

3.2. Materials:

3.2.1. Materials used for selection of participants

a. Questionnaire for obtaining demographic details, medical and developmental histories, awareness and variability of stuttering between languages, etiology, and associated problems
b. NIMH Socioeconomic Status Scale (Venkatesan, 2006)
c. Language use questionnaire (Jayashree & Prema, 2007)

3.2.2. Materials used for data collection

a. A set of ten common questions
b. Pictures related to common topics
c. Picture stories

d. Stuttering Severity Instrument – 3 (Riley, 1994)
e. English Language Test for Indian children- ELTIC (Bhuvaneswari & Jayashree, 2010)
f. Linguistic Profile Test- LPT (Karanth, Ahuja, Nagaraja, Pandit, & Shivashankar, 1991)
g. Computerized Re-standardized version of Kannada Articulation Test (Deepa & Savithri, 2011)
h. Edinburgh articulation test- EAT (Anthony, Bogle, Ingram, & McIssac, 1971)

3.3. Procedure

Children in the age range of 6-8 years diagnosed with stuttering by qualified Speech-language pathologist and fulfilling the inclusion criteria for clinical group were selected for the study. The selected participants were followed up for the purpose of data collection and further detailed assessment. An informed written consent was taken from the parents/caregivers of the children participating in the study. They were briefed about the research objectives and approximate duration of the testing. The study was carried out in 2 phases. Phase 1 included the administration of questionnaire related to nature of stuttering and language use to both parent and child and elicitation of the speech samples across various tasks (spontaneous speech, narration, and storytelling) in Kannada for ML and Kannada and English languages in BL group. Phase 2 included the administration of speech-language tests including SSI-3, LPT and Computerized Re-standardized KAT to ML CWS. However, in case of bilingual CWS, additional tests including ELTIC and EAT were administered.

3.3.1. Phase 1 - Administration of Questionnaire and elicitation of speech samples

The parents of the selected children were interviewed for a detailed history and asked to complete a questionnaire (Appendix I) regarding general information pertaining to stuttering including family history, educational history, types of disfluencies, age and nature of onset (sudden/gradual/precipitating factors), exposure to second language, language in which the child stutters the most while speaking, variability of stuttering and parent’s perceptual rating of severity specific to tasks and languages. The NIMH Scale was used to determine the socioeconomic status of each participant.

A Language use questionnaire (Jayashree & Prema, 2007) was used to obtain the information of languages used by BL children, especially the second language, English. The parents were instructed to provide information regarding the class or standard, mother tongue and other languages known, medium of instruction, languages they used/preferred while teaching the child at home and the languages their children used/preferred for communication. The other questions sought information regarding the languages taught as subjects in school, language preference of the child in school and best performance of the child in any particular language at school. Each statement was rated using a 3 point scale as always, most of the time and sometimes. Based on the language use of second language (English) only those children who obtained a minimum rating of 1 (most of the time) were grouped as bilingual.

All children participated in an informal clinician-client conversational interaction during the clinical interview. Spontaneous speech sample was elicited using a set of common questions pertaining to the individual's background, hobbies, monologue on the topics like home, school, hospital, market and favourite show. In addition, a set of four picture stories were used to elicit samples of connected discourse. Conversation, topic narration, story narration, picture description tasks were used in Kannada language for MLs and in both Kannada and English for BLs using the mentioned test materials and topics. The spontaneous speech was selected as stimuli as it forms a naturalistic data that provide insight into the language patterns that children actually use in day to day life. Initially all the tasks were carried out in Kannada language for 50% of the children and subsequently in English language and vice versa for the remaining 50% of BL children.

3.3.2. Phase 2 - Administration of speech-language tests

Stuttering Severity Instrument (SSI) was used to assess the severity of stuttering in both the languages, Kannada and English. The Linguistic Profile Test (LPT) assessed the language abilities of children in terms of their phonology, syntax and semantics in Kannada language. The subsections of the main section of LPT domains included, phonemic discrimination and phonetic expression (phonology), morphophonemic structures, plural forms, tenses, PNG markers, case markers, transitives, intransitives and causatives, sentence types, predicates, conjunctions, comparatives and quotatives, conditional clauses and participial constructions (syntax) and semantic discrimination, semantic expression, naming, lexical category, synonymy, antonymy, homonymy, polar questions, semantic anomaly, paradigmatic and syntagmatic relations, semantic contiguity and similarity (semantics). The English Language Test for Indian children-ELTIC was used to assess the language abilities of children in terms of syntax and semantics in English language. The subsections under the domain of semantic knowledge included body parts, nouns, verbs, categories, functions, prepositions, colors, quantity and opposites; pronouns, verb tenses and plurals, comparatives, and superlatives (morphological rules), and subject-verb agreement, negation, sentence repetition, judgment of correctness (syntactic rules). The Computerized Re-standardized version of Kannada Articulation Test was used to check for the phonological skills of the children as well as to elicit speech sample for all phonemes of the Kannada language. The picture stimuli were presented via computer one at a time and the children were instructed to name the target picture and talk about the picture in two sentences by placing the target word in initial position. This test was used for the purpose of including every phoneme of the Kannada language and thereby to control for the occurrence of phonemes in the initial positions of words or sentences, which is typically the problem in CWS. Similarly, in case of BL children, the Edinburgh articulation test was used to elicit the speech sample with all phonemes of the English language at word and sentence levels.

The testing of each participant was video recorded for various tasks using Sony video recorder. A speech sample of greater than 1000 words was elicited across all the tasks in each of the languages, Kannada and English. The recorded samples were transcribed verbatim, which involved the broad transcription using IPA and analyzed. The tasks were carried out within a duration of approximately two hours and four hours in case of MLs and BLs respectively. Sufficient breaks were provided within the time frame for ML children. However, in case of BL children the testing was carried out on separate days within a week's duration.

3.3.3. Data analysis

The data analysis included three main aspects. The first one included the assessment of types and degree of disfluencies in ML and BL CWS. The second aspect included the assessment of language ability in ML and BL (Kannada and English) CWS and CWNS groups. The third aspect included the assessment of degree of severity and language abilities in ML and BL CWS and across languages. Finally, the linguistic analyses of speech samples across the groups and languages were performed.

3.3.3.1. Analysis of disfluency patterns among CWS

The frequency of stuttering like disfluencies (SLDs) and other disfluencies (ODs) were analyzed from ML and BL CWS (both the languages) as proposed by Ambrose and Yairi (1999). SLDs are characterized by part-word repetitions, single-syllable repetitions, disrhythmic prolongations, blocks and broken words. Other disfluencies (ODs) involve interjections, revisions and multisyllabic/phrase repetition. Furthermore, the types of disfluencies, severity of stuttering and secondary behaviours exhibited by participants were analyzed using SSI 3 across the ML and BL clinical groups and between languages in BL CWS. The analysis of stuttering behaviours included the computation of the frequency of stuttering like disfluencies, estimated duration of the longest blocks for disfluent word and observable events. The SSI score was computed as proposed by Riley (1994). As the present study considered children as participants, the weighted SLDs (Ambrose & Yairi, 1999) was also calculated by the formula given below, where PW and SS are part- and single-syllable word repetitions, RU, is the mean number of repetition units, and DP is disrhythmic phonation per 100 syllables.

$$\text{Weighted SLD} = [(PW + SS) \times RU] + (2 \times DP)$$

3.3.3.2. Analysis of language abilities

The language abilities in both ML and BL children were tested using LPT and ELTIC in Kannada and English languages respectively. The scores obtained across the main section of LPT that included phonology, syntax and semantics were analyzed and compared within and across groups. The 2 subsections of phonology, 12 subsections of syntax and 13 subsections of semantics were also analyzed and compared within and across groups in Kannada language. The scores obtained across the main sections of ELTIC that included total reception and expression, semantic knowledge, morphological rules and syntactic rules were analyzed and compared between BL CWS and CWNS.

3.3.3.3. Analysis of severity of stuttering and linguistic abilities

The degree of severity of stuttering in ML and BL CWS was assessed using SSI-3. As proposed by Riley (1994), the severities of stuttering were classified as mild, moderate and severe degree which was based on the frequency and duration of moments of disfluencies and physical concomitants. The language abilities on the major sections of LPT (phonology, semantics, syntax, and language) and ELTIC (semantic knowledge, morphological rules, syntactic rules, and total language) were assessed in ML and BL CWS. Further, the scores obtained on these sections were analyzed with regard to degree of severity of stuttering in ML and BL CWS and across languages.

3.3.3.4. Linguistic analysis- Phonetic

The disfluencies occurring in ML and BL CWS were analyzed with regard to phonetic variables. The total number of disfluent phonemes was calculated from the transcribed sample of each participant. Further, these phonemes were categorized according to voicing, place and manner of articulation in Kannada and English languages as proposed by Upadhyaya (2000). The classification of consonants and vowels as described by Upadhyaya (2000) are mentioned in appendices II and III respectively. Similar classification was adopted for the English language as the participants included in the present study were children in the age range of 6-8 years. During this period children may not have reached the adult like pattern with regard to pronunciation of sounds in their second language and the influence of native language is most predominantly evident in childhood.

The consonants were classified according to place of articulation as velars, retroflex, dentals, labials, palatals, glottal and alveolars in Kannada and English languages. Further, the consonants were classified according to manner of articulation as stops, fricatives, affricates, flap, continuants, laterals and nasals in Kannada and English languages. All consonants were further classified as either voiced or unvoiced. The vowels were classified as short and long; central, front and back; low, mid and high; and total vowels and diphthongs.

For phonetic analysis, the initial instances of stuttering only were considered as the frequency of occurrence of disfluencies mostly occurred in the initial position of the word and the detailed analyses are as follows:

The analysis of phonetic variables included the relative difficulty of individual phonemes which was calculated using the following formula for each participant:

$$\text{Percentage of each disfluent phoneme} = \frac{\text{Total no. of disfluencies for each phoneme}}{\text{Total instances of occurrence of specific phoneme}} \times 100$$

The analysis of phonetic variables included the position of disfluent phoneme from the transcribed sample in ML and BL CWS. The positions of the disfluent phonemes were classified as initial, medial and final position and were calculated using the following formula.

$$\text{Percentage of each disfluent phoneme in initial position} = \frac{\text{Total no. of disfluent phonemes in initial position}}{\text{Total instances of occurrence of disfluent phonemes in all positions}} \times 100$$

$$\text{Percentage of each disfluent phoneme in medial position} = \frac{\text{Total no. of disfluent phonemes in medial position}}{\text{Total instances of occurrence of disfluent phonemes in all positions}} \times 100$$

$$\text{Percentage of each disfluent phoneme in final position} = \frac{\text{Total no. of disfluent phonemes in final position}}{\text{Total instances of occurrence of disfluent phonemes in all positions}} \times 100$$

3.3.3.5. Linguistic analysis- Morphological

The morphological variables included the analysis of word class and word length during the instances of stuttering. The word class measure involved the classification of fluent and disfluent word from the transcribed sample as content and function word for every utterance. Further, content words were categorized as nouns, main verbs, adverbs, and adjectives; and function words were categorized as pronouns, articles/particles, pre/post-positions, conjunctions and auxiliary verbs. Although in Kannada language the terms particles and post-positions are used in place of articles and prepositions (as per English language) respectively, to maintain uniformity the later terminologies are used to refer in both Kannada and English languages. The decision of specific category of content and function words was confirmed in consultation with clinical linguist.

The percentage of disfluencies across various word classes was calculated using the following formula for each participant.

$$\text{Percentage of disfluent content words} = \frac{\text{Total no. of disfluent content words}}{\text{Total instances of occurrence of content words}} \times 100$$

$$\text{Percentage of disfluent function words} = \frac{\text{Total no. of disfluent function words}}{\text{Total instances of occurrence of function words}} \times 100$$

$$\text{Percentage of disfluent nouns/verbs/adverbs/adjectives} = \frac{\text{Total no. of disfluent nouns/verbs/adverbs/adjectives}}{\text{Total instances of disfluent content words}} \times 100$$

$$\text{Percentage of disfluent pronouns/articles/prepositions/conjunctions/auxiliary verbs} = \frac{\text{Total no. of disfluent pronouns/articles/prepositions/conjunctions/auxiliary verbs}}{\text{Total instances of disfluent function words}} \times 100$$

Further, the analysis of word length involved the classification of fluent and disfluent words as number of syllables. A syllable is typically made up of a syllable nucleus, most often a vowel with optional initial and final margins typically, the consonants (Ladefoged, 2001). Each participant produced words with a range of 1 syllable to 8 syllables in the speech corpus data. Further, for statistical purpose the word length was classified as 1-2 syllables, >2-4 syllables, >4-6 syllables and >6 syllable categories. The percentage of disfluencies in terms of word length (no. of syllables) was calculated using the following formula for each participant.

$$\text{Percentage of disfluent words on word length of 1-2 syllables} = \frac{\text{Total no. of disfluent words on word length of 1-2 syllables}}{\text{Total instances of occurrence of 1-2 syllables word length}} \times 100$$

Similarly, the percentage of disfluencies for word length with >2-4 syllables, >4-6 syllables, and >6 syllable categories were calculated using similar formula as above.

3.3.3.6. Linguistic analysis- Syntactic

Sentence length is defined as the total number of function and content words within a sentence. For each participant's data set, the measure of words per sentence varied from two words to >9 words. For statistical purpose, the sentence length was further classified as 2-3 words, >3-6 words, >6-9 words and >9 words categories. The percentage of disfluencies in terms of no. of words in a sentence was calculated using the following formula.

$$\text{Percentage of disfluent sentences with 2-3 words} = \frac{\text{Total no. of disfluent sentences with 2-3 words}}{\text{Total instances of occurrence of sentences with 2-3 words}} \times 100$$

Similarly, the percentage of disfluencies for sentence length with >3-6 words, >6-9 words and >9 words categories were calculated using the above formula.

Additionally, the frequency of occurrence of disfluencies at sentence level specific to noun and verb phrases in a sentence was determined for each participant. A noun phrase comprises of a noun (person, place, or thing) and the modifiers which distinguish it. Modifiers can occur either prior or after the noun, and includes articles, pronouns, possessive nouns, adjectives, participles, prepositional phrases, adjective clauses, participle phrases, and infinitives. The verb phrase is a syntactic unit composed of at least one verb and its dependents such as objects, complements, and other modifiers (Greenbaum, 2005).

The percentage of disfluencies across noun and verb phrases was calculated using the following formula:

$$\text{Percentage of disfluent noun phrase} = \frac{\text{Total no. of disfluent noun phrases}}{\text{Total instances of occurrence of noun phrases}} \times 100$$

$$\text{Percentage of disfluent verb phrase} = \frac{\text{Total no. of disfluent verb phrases}}{\text{Total instances of occurrence of verb phrases}} \times 100$$

3.3.4. Statistical analyses

The data analyses from the speech corpus of 35 ML CWS, 25 BL CWS and equal number of age and gender matched children with no stuttering (CWNS) were compiled and subjected to statistical analysis using the software SPSS 17.0 (Statistical Package for Social Sciences, Version 17.0). The data was subjected to tests of normality, depending upon which parametric or non-parametric statistical measures were employed.

Test of Normality

It is important to ascertain whether the data show a deviation from normality. An assessment of the normality of data was performed with the variables in question by using the Shapiro-Wilk test. The total variables included in linguistic determinants and patterns of disfluencies were 56 and 112 for ML and BL group of CWS respectively. Out of 56, 21variables presented with a p-value of >0.05 indicating normal distribution of data, while for 35 variables the data were not normally distributed as the p values were < 0.05 in ML group. Out of 112 variables in BL group, 69 variables presented with a p-value of >0.05 which indicates normal distribution of data, while for 43 variables data were not normally distributed.

Considering the language abilities (LPT and ELTIC) the total variables included 28 and 34 in both groups of ML and BL children respectively. It was noted that only 4 variables in the CWS group and 3 in the CWNS group presented normality among the ML children. Similarly, only 5 variables in the CWS group and 4 in the CWNS group presented normality among the BL children. The summary of test results of normality for patterns of disfluencies, linguistic determinants, and language abilities assessed using LPT and ELTIC are presented in appendix IV.

Outlier identification

Box plots analysis were employed to identify the outliers and for comparing the distribution of the sample within the data. The analysis revealed that the participants who stood as an outlier differed across the variables considered in the study. For example, Figures 3.1 and 3.2 illustrate the participants who stood as outliers for various categories under investigation for the ML (27, 8, 33, 22, 6, 9, 12, and 21) and BL groups (7, 25, 20, 24, 8, 5, and 22) respectively.

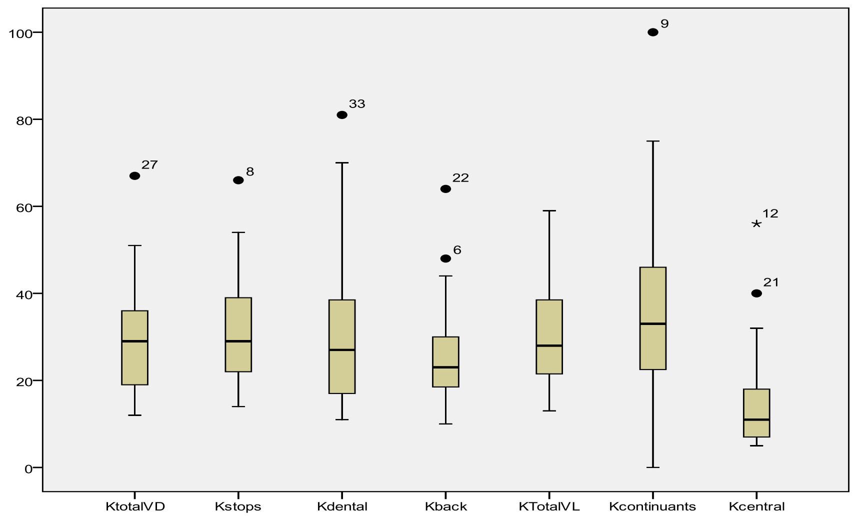


Figure 3.1. Box plots analyses for a set of disfluent categories in ML group.

For the purpose of reaching normality, the participants identified as outliers (initially one, then two, finally around eight participants) were excluded from the sample in stages. In spite of this removal of the outliers, the results remained nearly identical. In other words, the distribution remained relatively the same regardless of the presence or absence of the outliers. Hence, the outliers were retained and the administration of parametric statistics was adopted for those variables with normality while non-parametric statistics were used for those without normality.

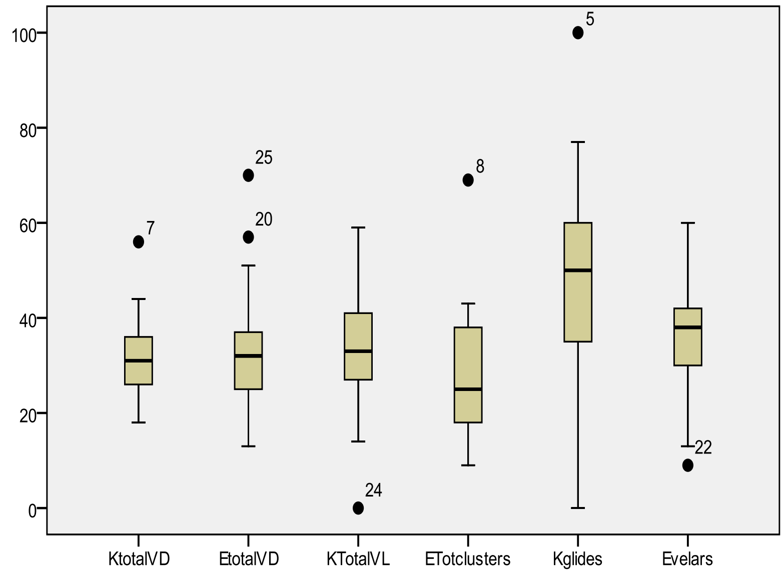


Figure 3.2. Box plots analyses for a set of disfluent categories in BL group.

The mean, standard deviation and median values were calculated using SPSS software for the patterns of disfluencies and linguistic determinants in ML and BL CWS (Kannada and English). Further, the mean and standard deviation were calculated for language abilities in Kannada and English language for ML and BL CWS and CWNS. Parametric statistics, such as One- way repeated measures Analysis of variance (ANOVA) and paired t-test were employed for those variables that showed normality, while non-parametric statistics such as the Mann-Whitney U test and Wilcoxon Signed Rank test were adopted for those without normality.

RESULTS

The study aimed to analyze the patterns of disfluencies, language abilities and linguistic determinants of disfluencies in monolingual (ML) and bilingual (BL) children with stuttering (CWS). Data obtained on 35 ML CWS, 25 BL CWS and equal number of age and gender matched ML and BL children with no stuttering (CWNS) were compared on language measures. In addition, the ML and BL CWS were compared with respect to types of disfluencies, severity of stuttering, and linguistic determinants within and across languages. These measures were compiled and subjected to statistical analyses using the software SPSS 17.0 (Statistical Package for Social Sciences, Version 17.0). The data was subjected to tests of normality, depending upon which, parametric or non-parametric statistical measures were employed.

Inter-judge and Intra-judge reliability:

20% of each from the ML and BL samples were subjected to inter-judge and intra- judge reliability. Two judges including one speech-language pathologist and the investigator served as judges for determining the inter judge reliability measure. The other judge was a qualified Speech-language pathologist with two years of clinical and research experience with stuttering. The judge was instructed about the transcription of the fluent and disfluent speech sample with regards to patterns of disfluencies and linguistic determinants. The investigator transcribed 20% of the sample again after a span of one week from the initial analysis. The Cronbach's alpha test was used to obtain the reliability index for comparison of inter and intra-judge reliability. The inter judge reliability ranged from 0.76 to 0.89 and 0.72 to 0.91 for variables under study in ML and BL sample respectively. Further, the intra judge reliability ranged from 0.81 to 0.86 and 0.83 to 0.90 for various variables in ML and BL samples respectively.

The results of the study are discussed under 4 major sections as follows:

4.1: Types of disfluencies and severity of stuttering

- 4.1.1: SLDs and ODs across ML and BL CWS
- 4.1.2: SLDs and ODs within ML and BL CWS
- 4.1.3. Degree of severity based on SSI and WSLD

4.2: Language Abilities

- 4.2.1: Performance on the Linguistic Profile Test in Kannada
  - 4.2.1.1: Major sections of LPT
  - 4.2.1.2: Subsections of LPT across CWS and CWNS in MLs and BL
  - 4.2.1.3: Subsections of LPT across ML and BL in CWS and CWNS
- 4.2.2: Performance on the English Language Test for Indian Children

4.3: Stuttering severity and language abilities

- 4.3.1: Based on LPT in ML CWS
- 4.3.2: Based on LPT in BL CWS
- 4.3.3: Based on ELTIC in BL CWS

4.4: Linguistic determinants of disfluencies

- 4.4.1: Phonetic determinants of disfluencies
  - 4.4.1.1: Disfluent phonemes
  - 4.4.1.2: Phoneme position
- 4.4.2: Morphological determinants of disfluencies
  - 4.4.2.1: Word class
  - 4.4.2.2: Word length
- 4.4.3: Syntactic determinants of disfluencies
  - 4.4.3.1: Sentence structure
  - 4.4.3.2: Sentence length

4.1. Types of disfluencies and severity of stuttering

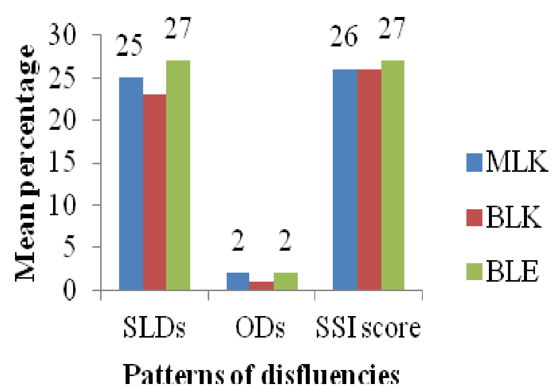
The instances of disfluencies with regard to frequency, duration of disfluencies and physical concomitants in ML and BL CWS were analyzed. The disfluencies were categorized as stuttering like (SLDs) and other disfluencies (ODs) as listed by Ambrose and Yairi (1999). SLDs are characterized by part-word repetitions, single-syllable repetitions, disrhythmic prolongations, blocks and broken words. Other disfluencies (ODs) involve interjections, revisions and multisyllabic word/phrase repetition. Table 4.1 and Figure 4.1 illustrate the descriptive statistics for disfluencies and the total scores obtained in the stuttering severity instrument (SSI) across the groups. SSI 3 was used to assess the severity of stuttering in both the groups. The test enables the examiner to compute the frequency, duration of disfluencies and physical concomitants to arrive at the total overall score and the severity.

Table 4.1

Mean, SD and Median of percent disfluencies and total SSI scores in CWS across groups

Type of	MLK (N = 35)			BLK (N = 25)			BLE (N = 25)		
disfluencies	Mean	SD	Median	Mean	SD	Median	Mean	SD	Median
SLDs	25.17	14.23	23.00	23.46	12.91	20.00	26.52	10.92	25.00
ODs	01.87	01.09	02.00	01.46	00.73	01.00	01.98	01.27	02.00
SSI score	26.00	03.40	26.00	26.36	03.83	27.00	26.68	03.49	26.00

Note. SLDs = stuttering like disfluencies, ODs = other disfluencies, SSI = stuttering severity instrument, MLK = monolingual Kannada, BLK = bilingual Kannada, BLE = bilingual English.



Note. SLDs = stuttering like disfluencies, ODs = other disfluencies, SSI = stuttering severity instrument, MLK = monolingual Kannada, BLK = bilingual Kannada, BLE = bilingual English.

Figure 4.1. Mean percentage of disfluencies for SLDs and ODs across groups.

4.1.1. SLDs and ODs across ML and BL CWS

The mean percentage of SLDs/ODs was calculated by considering the ratio of total instances of SLDs/ODs to the total number of words spoken, multiplied by 100. The mean total SSI score was calculated by summing up the scores obtained for frequency, duration of disfluencies and physical concomitants.

The results of Mann-Whitney U test revealed no significant difference across ML and BL groups for the occurrence of SLDs, ODs and total SSI scores. The results suggested that as a whole similar trends were noted for the occurrence of both types of disfluencies as well as SSI scores (|z| = 0.61; p >0.05) in both the groups. Table 4.2 shows the results of non-parametric tests for SLDs and ODs in both the groups. The present findings suggest a similar trend for the occurrence of disfluencies between groups. It was found that as a group the CWS behaved similarly in both ML and BL contexts.

Table 4.2

Results of non-parametric tests for disfluencies in groups of CWS

Groups	MLK		BLK		BLE		Groups	BLK and BLE		MLK and BLK	
Disfluencies	|z|	p	|z|	p	|z|	p	Disfluencies	|z|	p	|z|	p
SLDs and ODs	5.16	**0.00***	6.73	**0.00***	4.37	**0.00***	SLDs	1.32	0.18	0.72	0.47
							ODs	1.77	0.07	1.52	0.12

Note. SLDs = stuttering like disfluencies, ODs = other disfluencies, * = significant at 0.01 level, MLK = monolingual Kannada, BLK = bilingual Kannada, BLE = bilingual English.

4.1.2. SLDs and ODs within ML and BL CWS

Considering both groups, Wilcoxon signed rank test revealed significant difference between the occurrence of SLDs and ODs. It was found that SLDs were significantly higher compared to ODs, in both ML and BL CWS. In the BL group, Wilcoxon signed rank test was used to compare the frequency of disfluencies across languages. The results suggested a similar trend for the occurrence of both SLDs and ODs in both the languages of BL CWS. It can be inferred that SLDs were significantly higher compared to ODs, which confirms the presence of stuttering in both languages of

BL CWS. Figure 4.1 displays the mean percentage of disfluencies for SLDs, ODs and SSI score in the groups. In the BL group, the comparisons of total SSI scores were performed using the parametric paired t-test. The analysis revealed no significant difference ($t(24) = 1.28$, $p > 0.05$) between the total SSI score in both Kannada and English, suggesting a similar trend.

4.1.3. Degree of severity in ML and BL CWS

4.1.3.1. Degree of severity based on SSI

Based on the total SSI scores CWS were categorized under various degrees of severity. The analysis of ML group of CWS corresponds to 27 (77%) under moderate degree and 8 (23%) under severe degree of severity. The findings show that majority of CWS had moderate degree of severity. Notably, none of the ML CWS had mild degree of severity.

It is interesting to note the distribution of stuttering within and across languages in BL CWS. The severity of stuttering as per the SSI was analyzed for Kannada and English languages in BL CWS. The mean percentage of severity of stuttering included 2 (8%), 15 (60%) and 8 (32%) corresponding to mild, moderate and severe degree of stuttering respectively for Kannada language. It was observed that majority of CWS in the BL group had moderate degree of stuttering in Kannada. Almost on the similar lines, severity of stuttering included 16 (64%) and 9 (36%) corresponding to moderate and severe degree of stuttering respectively for English language in BL CWS. Interestingly, none of the BL CWS exhibited mild degree of severity in English language. Table 4.3 displays the cross tabulation results while comparing the degree of severity in Kannada and English languages.

The findings indicate that 20 (80%) of BL CWS had same degree of severity in the two languages based on SSI score. A greater severity of stuttering was noticed in 1 (4%) in the first language, L1 (Kannada), while 4 (16%) had greater severity of stuttering in the second language, L2 (English). These findings indicate that in majority of BL CWS exhibited the same degree of severity in both languages.

Table 4.3
Results of cross tabulation data of degree of severity between languages

		Severity in English			
	Severity	Mild	Moderate	Severe	Total
Severity in Kannada	Mild	0	02	0	02
	Moderate	0	13	2	15
	Severe	0	01	7	08
	Total	0	16	9	25

The statistical measure, Kappa coefficient, was used to determine the agreement between the degrees of severity based on SSI score across languages (Table 4.3). The results indicated a significant Kappa coefficient of 0.6 ($p < 0.05$), suggesting a significant agreement between the severities across languages in BL CWS.

4.1.3.2. Degree of severity based on weighted stuttering like disfluencies (SLDs)

The patterns of disfluency distribution in the groups of CWS were examined using a weighted measure as devised by Ambrose and Yairi (1999). Weighted SLD is a single score metric which reflects the frequency and extent of repetitions (iterations), as well as the presence and duration of disrhythmic phonation. Such a metric highlights the degree of severity by considering only SLDs and thereby placing greater weightage to extent and type of disfluencies. Table 4.5 provides details of the severity based on weighted SLD scores in ML and BL CWS (Kannada and English languages). The scores obtained for weighted SLD yielded the degree of severity which was compared within and across groups of CWS.

The analysis of ML group of CWS corresponds to 1 (3%), 25 (71%) and 9 (26%) for mild, moderate and severe degree of stuttering respectively based on weighted SLD. The findings show that majority of CWS presenting with moderate degree followed by severe and mild degree of severity. Analyses of distribution of weighted SLDs within and across languages in BL group revealed 17 (68%) and 8 (32%) corresponding to moderate and severe degree of stuttering respectively in Kannada language. The findings reveal that majority of CWS exhibited moderate degree. Interestingly, none of the BL CWS exhibited mild degree of severity in Kannada language. In English language severity based on weighted SLD corresponded to 2 (8%), 13 (52%) and 10 (40%) for mild, moderate and severe degree of stuttering respectively. Table 4.4 displays the results of cross tabulation data of weighted SLD between languages.

Table 4.4
Results of cross tabulation data of weighted SLD between languages

		Severity in English			
	Severity	Mild	Moderate	Severe	Total
Severity in Kannada	Mild	00	00	00	00
	Moderate	02	11	04	17
	Severe	00	02	06	08
	Total	02	13	10	25

The statistical measure, Kappa coefficient, was used to determine the agreement between the degrees of severity based on weighted SLD across languages. The results indicated a significant Kappa coefficient of 0.4 ($p < 0.05$), suggesting a significant agreement between severity across languages in BL CWS.

4.1.3.3. Comparison of severity of stuttering based on SSI and WSLD scores

The comparisons of results of the SSI and WSLD scores in the ML group, revealed that both these measures exhibited an agreement of 72% i.e, similar degree of severity were obtained in 72% of the participants. Further, it was noted that 14% of the time, when the SSI score illustrated a moderate degree of severity of stuttering, the WSLD depicted it as severe stuttering, while another 3% of the time, the WSLD presented it as mild. Similarly, when the SSI score presented with a severe degree of stuttering, 11% of the time the WSLD depicted a moderate degree of severity. Tables 4.5 and 4.6 displays the results of severity of stuttering based on SSI and WSLD scores in each participant of ML and BL CWS and in both the languages.

Considering the bilingual CWS, the comparisons between SSI and WSLD scores revealed a similar degree of severity in 68% and 60% of the participants in the Kannada and English languages respectively. The detailed analyses in Kannada revealed that 12% of the time, when the SSI illustrated a moderate degree of severity, the WSLD depicted it as severe stuttering. Further, while the SSI presented with a mild degree of stuttering (20%), the WSLD differed and displayed a moderate degree. In the same way, when such comparisons were carried out in English, it was noted that when the SSI presented with moderate stuttering, 20% of the time the WSLD illustrated severe stuttering, while another 4% of the time, the WSLD presented it as mild severity. Similarly, 16% of the time, when the SSI depicted a severe degree of stuttering, the WSLD presented with a moderate degree of stuttering. In summary, the SSI and WSLD scores presented similar severity in majority of CWS in both ML and BL groups (Table 4.5). The probable differences between the SSI and WSLD degree of severity in few participants could be due to the procedure involved in calculation. The degree of severity based on WSLD involved more weightage on disrhythmic phonation and iterations, whereas the degree of severity based on SSI contributed to the presence of secondary behaviours; which are not accounted for in WSLD.

Table 4.5

Severity of stuttering based on SSI and WSLD scores in ML CWS

Participants	SSI Score	SSI severity	WSLD Score	WSLD severity
P 1	29	Sev	21	Mod
P 2	35	Sev	25	Mod
P 3	34	Sev	34	Sev
P 4	31	Sev	69	Sev
P 5	31	Sev	22	Mod
P 6	28	Sev	71	Sev
P 7	30	Sev	38	Sev
P 8	30	Sev	23	Mod
P 9	27	Mod	36	Sev
P 10	27	Mod	16	Mod
P 11	26	Mod	27	Mod
P 12	24	Mod	11	Mod
P 13	25	Mod	33	Sev
P 14	23	Mod	20	Mod
P 15	23	Mod	8	Mild
P 16	23	Mod	13	Mod
P 17	21	Mod	13	Mod
P 18	24	Mod	31	Sev
P 19	26	Mod	29	Mod
P 20	25	Mod	21	Mod
P 21	24	Mod	18	Mod
P 22	21	Mod	12	Mod
P 23	21	Mod	16	Mod
P 24	25	Mod	11	Mod
P 25	27	Mod	24	Mod
P 26	22	Mod	21	Mod
P 27	24	Mod	32	Sev
P 28	27	Mod	59	Sev
P 29	24	Mod	27	Mod
P 30	27	Mod	15	Mod
P 31	26	Mod	28	Mod
P 32	26	Mod	24	Mod
P 33	26	Mod	29	Mod
P 34	24	Mod	15	Mod
P 35	24	Mod	18	Mod

Note. SSI = stuttering severity instrument, WSLD = weighted stuttering like disfluencies, Mod = moderate, Sev = severe.

Table 4.6
Severity of stuttering based on SSI and WSLD scores in BL CWS

Participants	Severity of stuttering							
	K SSI	K SSI Sev	K WSLD	K WSLD Sev	E SSI	E SSI Sev	E WSLD	E WSLD Sev
P 1	27	Mod	13	Mod	29	Sev	29	Mod
P 2	25	Mod	21	Mod	25	Mod	19	Mod
P 3	24	Mod	12	Mod	24	Mod	7	Mild
P 4	31	Sev	32	Sev	31	Sev	45	Sev
P 5	24	Mod	10	Mod	24	Mod	7	Mild
P 6	26	Mod	18	Mod	26	Mod	16	Mod
P 7	29	Sev	54	Sev	29	Sev	40	Sev
P 8	35	Sev	40	Sev	35	Sev	50	Sev
P 9	31	Sev	32	Sev	33	Sev	52	Sev
P 10	32	Sev	26	Mod	30	Sev	18	Mod
P 11	28	Sev	28	Mod	26	Mod	16	Mod
P 12	27	Mod	22	Mod	27	Mod	33	Sev
P 13	27	Mod	16	Mod	29	Sev	24	Mod
P 14	20	Mild	10	Mod	22	Mod	13	Mod
P 15	24	Mod	29	Mod	24	Mod	35	Sev
P 16	22	Mod	12	Mod	24	Mod	16	Mod
P 17	27	Mod	30	Sev	27	Mod	62	Sev
P 18	24	Mod	17	Mod	24	Mod	17	Mod
P 19	27	Mod	34	Sev	25	Mod	16	Mod
P 20	27	Mod	30	Sev	27	Mod	40	Sev
P 21	30	Sev	20	Mod	30	Sev	35	Sev
P 22	20	Mild	10	Mod	22	Mod	10	Mod
P 23	29	Sev	38	Sev	29	Sev	21	Mod
P 24	21	Mod	13	Mod	23	Mod	32	Sev
P 25	22	Mod	11	Mod	22	Mod	24	Mod

Note. Mod = moderate, Sev = severe, KSSI = SSI Score in Kannada, KSSI Sev = severity in Kannada based on stuttering severity instrument, KWSLD = Weighted stuttering like disfluencies Score in Kannada, KWSLD Sev = severity in Kannada based on weighted stuttering like disfluencies, ESSI = SSI Score in English, ESSI Sev = severity in English based on stuttering severity instrument, EWSLD = Weighted stuttering like disfluencies Score in English, EWSLD Sev= severity in English based on weighted stuttering like disfluencies.

4.2. Language abilities of children with stuttering

The language abilities of CWS and age and gender matched CWNS groups were analyzed using the standardized test such as Linguistic profile test (LPT; Karanth et al., 1991) in Kannada and English language test for Indian children (ELTIC, Bhuvaneswari & Jayashree, 2011). The LPT assessed the language abilities in terms of phonology, syntax and semantics in Kannada language in both the ML and BL groups. The ELTIC assessed the language abilities in terms of syntax and semantics in English language in BL CWS.

4.2.1. Comparison of language abilities of CWS and CWNS based on results of LPT

The data analyses of the major section of LPT domains such as phonology, syntax and semantics were compared between the CWS and age and gender matched CWNS. The comparisons of subsections of the major section of LPT domains included phonemic discrimination and phonetic expression (under phonology), morphophonemic structures, plural forms, tenses, person number gender (PNG) markers, case markers, transitives, intransitives and causatives, sentence types, predicates, conjunctions, comparatives and quotatives, conditional clauses and participial constructions (under syntax) and semantic discrimination, semantic expression, naming, lexical category, synonymy, antonymy, homonymy, polar questions, semantic anomaly, paradigmatic and syntagmatic relations, semantic contiguity and similarity (under semantics).

The language abilities based on LPT results were analyzed for 2 categories such as ML and BL and in 2 groups, CWS and CWNS. The detailed findings while comparing the LPT test results for ML CWS and CWNS, BL CWS and CWNS, ML and BL CWS, ML and BL CWNS are as follows.

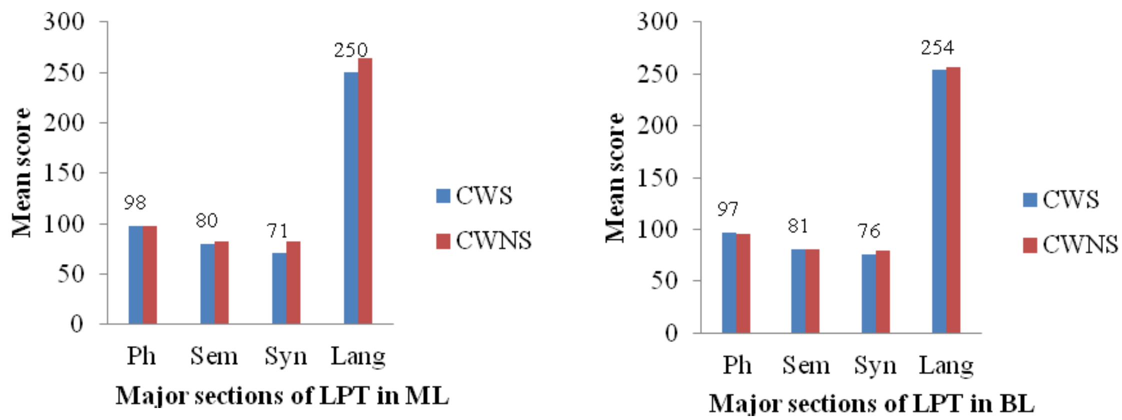
4.2.1.1. Comparison of major sections of LPT for ML (CWS and CWNS) and BL (CWS and CWNS)

The mean scores of the major section of LPT domains such as phonology, syntax, semantics and language were analyzed and compared between ML CWS and CWNS; and BL CWS and CWNS. Table 4.7 illustrates the mean raw scores and standard deviation for major sections of LPT in the ML and BL CWS and CWNS.

Table 4.7
Mean and SD of major sections of LPT in ML and BL CWS and CWNS

Major sections of LPT		ML CWS (N = 35)	ML CWNS (N = 35)	BL CWS (N = 25)	BL CWNS (N = 25)
Total Phonology	M	98.34	98.08	96.92	96.24
	SD	01.45	01.44	01.63	01.76
Total Semantics	M	80.47	82.42	81.38	80.64
	SD	07.90	06.01	07.33	07.83
Total Syntax	M	70.72	83.01	75.64	79.16
	SD	15.22	08.65	10.36	08.82
Total Language	M	249.55	263.52	253.94	256.04
	SD	22.41	15.07	17.71	16.74

The summary of scores from table 4.7 indicates almost similar mean scores for the total phonology and total semantics across CWS and CWNS groups. However, the total syntax and language mean scores showed an increased value in CWNS compared to CWS in both ML and BL groups. Table 4.8 displays the results of Mann Whitney U test across CWS and CWNS in ML and BL groups. Figure 4.2 illustrates the mean scores of the major sections of LPT across the CWS and CWNS in ML and BL groups.



Note. Ph = Phonology, Sem = Semantics, Syn = Syntax, Lang = Language, ML = monolingual, BL = bilingual.

Figure 4.2. Mean scores on the major sections of LPT in ML and BL groups.

Table 4.8
Results of Mann Whitney U test for major sections of LPT across CWS and CWNS

Major sections of LPT	ML CWS and CWNS		BL CWS and CWNS	
	|z|	p	|z|	p
Total Phonology	0.74	0.45	1.53	0.12
Total Semantics	1.04	0.29	0.13	0.89
Total Syntax	3.67	**0.00***	1.45	0.14
Total Language	2.61	**0.00***	0.45	0.64

Note. *= significant at 0.01 level.

Results of Mann-Whitney U test suggest that ML CWNS scored significantly higher than CWS on total syntax and total language sections of the LPT. It can be concluded that ML CWNS performed better for these sections compared to CWS. However, the results of Mann-Whitney U test suggest no significant difference for all the

4 major sections of LPT across BL CWNS and CWS, suggesting a similar trend. Findings indicated varied results in ML and BL groups with regard to syntax and total language.

4.2.1.2. Comparison of subsections of LPT for ML (CWS and CWNS) and BL (CWS and CWNS)

The mean scores of subsections of LPT domains as mentioned earlier were analyzed and compared between ML CWS and CWNS; and BL CWS and CWNS. Tables 4.9 and 4.10 illustrate the mean raw scores and standard deviation for subsections of phonology, semantics and syntax section in ML and BL across CWS and CWNS.

Table 4.9
Mean and SD of subsections of LPT (Phonology & Semantics) in ML and BL across CWS and CWNS

Subsections of Phonology and Semantics	ML				BL			
	CWS		CWNS		CWS		CWNS	
	M	SD	M	SD	M	SD	M	SD
Phonemic Discrimination	46.34	1.45	46.08	1.44	44.92	1.63	44.16	1.74
Phonetic Expression	52.00	0.00	52.00	0.00	52.92	0.00	52.00	0.00
Total Phonology	98.34	1.45	98.08	1.44	96.92	1.63	96.24	1.76
Semantic Discrimination	15.00	0.00	15.00	0.00	15.00	0.00	15.00	0.00
Naming	20.00	0.00	20.00	0.00	20.00	0.00	20.00	0.00
Lexical Category	10.77	2.07	11.14	2.00	09.48	1.08	09.00	1.25
Synonymy	03.20	0.75	03.57	0.85	03.92	0.81	03.32	1.51
Antonymy	04.02	0.85	04.48	0.56	04.16	0.85	04.48	1.12
Homonymy	01.95	0.77	01.97	0.86	01.42	0.49	00.96	0.40
Polar Questions	08.71	1.04	09.65	0.63	09.00	1.08	09.68	1.21
Semantic Anomaly	04.14	0.80	04.05	1.02	03.80	0.76	04.12	1.12
Paradigmatic Relations	03.77	0.94	03.91	0.81	03.88	0.78	03.76	0.96
Syntagmatic Relations	03.28	0.66	03.48	0.56	03.72	0.67	03.56	1.00
Semantic Contiguity	03.00	0.93	03.22	0.87	03.56	0.82	03.60	1.00
Semantic Similarity	02.74	0.95	02.74	0.44	03.68	0.98	03.20	1.29
Total Semantics	80.47	7.90	82.42	6.01	81.38	7.33	80.64	7.83

The summary of results from the table 4.9 indicates that the mean scores for the subsections in phonology showed almost similar scores across CWS and CWNS. The score for phonetic expression remained the same across all the groups. The total semantics score was slightly reduced in ML CWS compared to CWNS, while in the BLs both the groups showed similar score. The scores obtained for semantic discrimination and naming remained consistent across all the groups. The remaining subsections of semantics presented an inconsistent pattern in ML and BL across CWS and CWNS.

Table 4.10
Mean and SD of subsections of LPT (Syntax) in ML and BL across CWS and CWNS

Subsections of Syntax	ML				BL			
	CWS		CWNS		CWS		CWNS	
	M	SD	M	SD	M	SD	M	SD
Morphophonemic Structures	7.41	1.70	8.21	1.07	7.90	1.11	8.22	1.12
Plural Forms	3.72	0.91	4.25	0.72	3.84	0.74	3.66	0.71
Tenses	3.50	0.97	3.97	0.83	3.60	0.64	3.58	0.65
Person Number Gender Markers	7.64	1.50	8.80	1.00	7.78	1.12	8.02	0.98
Case Markers	7.20	1.60	8.40	1.28	7.48	1.00	8.00	0.81
Transitives, Intransitives, Causatives	7.05	1.79	8.80	1.15	7.84	1.17	8.36	0.99
Sentence Types	7.31	1.47	8.17	1.27	7.92	1.22	8.16	1.40
Predicates	7.37	1.49	8.48	0.91	7.72	1.02	7.64	1.25
Conjunctions, Comparatives, and Quotatives	6.71	1.52	8.31	0.90	6.92	1.22	7.72	0.89
Conditional Clauses	6.74	1.46	8.14	1.37	7.12	1.12	7.76	1.12
Participle Constructions	6.37	1.97	7.57	1.26	7.52	1.61	7.20	1.77
Total Syntax	70.72	15.22	83.01	8.65	75.64	10.36	79.16	8.82
Total Language	249.55	22.41	263.52	15.07	253.94	17.71	256.04	16.74

The summary of results from table 4.10 indicates that the total syntax and language score was reduced in ML and BL CWS compared to CWNS. The scores obtained for majority of the subsections of syntax was reduced in ML CWS, but in BL group an inconsistent pattern was noted across CWS and CWNS. The Mann-Whitney U test was used to statistically compare the results obtained by CWS and CWNS for subsections of LPT. Tables 4.11 and 4.12 depict the results of Mann Whitney U test for subsections of phonology, semantics, and syntax across CWS and CWNS in ML and BL groups respectively.

Table 4.11

Results of Mann Whitney U test for subsections of Phonology and Semantics across CWS and CWNS in ML and BL groups

Phonology and Semantics	ML CWS and CWNS		BL CWS and CWNS	
	|z|	p	|z|	p
Phonemic Discrimination	0.74	0.45	1.70	0.08
Phonetic Expression	0.00	1.00	0.00	1.00
Total Phonology	0.74	0.45	1.53	0.12
Semantic Discrimination	0.00	1.00	0.00	1.00
Naming	0.00	1.00	0.00	1.00
Lexical Category	0.76	0.44	1.33	0.18
Synonymy	1.54	0.12	1.07	0.28
Antonymy	2.28	**0.02***	1.97	**0.04***
Homonymy	0.06	0.94	3.34	**0.00***
Polar Questions	4.29	**0.00***	3.15	**0.00***
Semantic Anomaly	0.12	0.90	2.02	**0.04***
Paradigmatic Relations	0.44	0.66	0.41	0.68
Syntagmatic Relations	1.53	0.12	0.55	0.57
Semantic Contiguity	1.27	0.20	0.12	0.90
Semantic Similarity	0.60	0.54	1.49	0.13
Total Semantics	1.04	0.29	0.13	0.89

Note. *= significant at 0.01 level.

The findings of Mann-Whitney test revealed significant difference for antonymy and polar questions across ML CWS and CWNS, where ML CWS had poorer scores in these subsections compared to CWNS. Similarly, the findings of Mann-Whitney U test revealed significant difference for the subsections of antonymy, homonymy, polar questions and semantic anomaly across BL CWS and CWNS, where BL CWS had poorer scores in all these subsections compared to CWNS, with the exception of homonymy.

The findings of Mann-Whitney U test revealed significant difference for all the subsections of syntax with the exception of morphophonemic structures across ML CWS and CWNS, ML CWS having poorer scores in all these subsections compared to CWNS. Similarly, the findings of Mann-Whitney revealed significant difference for the subsections of conjunctions and conditional clauses across BL CWS and CWNS, where BL CWS had poorer scores in both these subsections compared to CWNS.

Table 4.12

Results of Mann Whitney U test for subsections of Syntax across CWS and CWNS in ML and BL groups

Syntax section of LPT	ML CWS and CWNS		BL CWS and CWNS	
	|z|	p	|z|	p
Morphophonemic Structures	1.82	0.06	1.09	0.27
Plural Forms	2.52	**0.01***	0.83	0.40
Tenses	1.91	**0.05***	0.05	0.95
Person Number Gender Markers	3.21	**0.00***	0.71	0.47
Case Markers	3.25	**0.00***	1.74	0.08
Transitives, Intransitives, and Causatives	4.31	**0.00***	1.78	0.07
Sentence Types	2.53	**0.01***	0.49	0.61
Predicates	3.35	**0.00***	0.03	0.97
Conjunctions, Comparatives, and Quotatives	4.26	**0.00***	2.10	**0.03***
Conditional Clauses	3.91	**0.00***	1.97	**0.04***
Participle Constructions	2.57	**0.01***	0.50	0.61
Total Syntax	3.67	**0.00***	1.45	0.14
Total Language	2.61	**0.00***	0.45	0.64

Note. *= significant at 0.05 level.

To summarize, ML CWNS scored significantly better than CWS on total syntax and total language sections of LPT. The findings of subsections of LPT revealed significant difference for antonymy and polar questions under the section of semantics, and for all the subsections of syntax with the exception of morphophonemic structures across ML CWS and CWNS. The ML CWS had poorer scores in these subsections compared to CWNS. However, no significant differences were obtained for the subsections of phonology across both groups of children.

On the contrary, no significant difference was noted for all the 4 major sections of LPT across BL CWNS and CWS. The findings of the subsections of LPT revealed significant difference for the subsections of antonymy, homonymy, polar questions and semantic anomaly under the section of semantics, and conjunctions, quotatives, and conditional clauses under the section of syntax, across BL CWS and CWNS. Further analysis indicated that BL CWS had poorer scores in all these subsections compared to CWNS, with the exception of homonymy. Similar to the results of the monolingual group, no significant difference was obtained for the subsections of phonology across both groups of bilingual children.

4.2.1.3. Comparison of LPT test results for CWS (ML and BL) and CWNS (ML and BL)

In this section, the mean scores of the main and the subsection of LPT domains were compared in CWS (across ML and BL) and CWNS (across ML and BL). Details of the descriptive scores are mentioned in the earlier section (Tables 4.9 and 4.10). Figure 4.4 illustrates the mean scores of the major sections of LPT in CWS and CWNS across ML and BL groups. The Mann Whitney U test was performed to compare the LPT test results for all groups in CWS (ML and BL) and CWNS (ML and BL) and the results are displayed in table 4.13.

Table 4.13

Results of Mann Whitney U test for major sections of LPT across ML and BL CWS and CWNS

Major sections of LPT	ML and BL CWS		ML and BL CWNS	
	|z|	p	|z|	p
Total Phonology	3.10	**0.00***	3.77	**0.00***
Total Semantics	0.63	0.52	0.04	0.96
Total Syntax	1.08	0.27	1.52	0.12
Total Language	0.93	0.35	1.44	0.15

Note. *= significant at 0.01 level.

In phonology section, the results of Mann Whitney test indicated significant difference for total phonology score between the ML and BL groups of CWS and CWNS. The findings revealed poorer scores in bilinguals as compared to monolinguals in both groups of children. However, no significant difference was found for the other major sections of LPT across ML and BL groups of children. The comparisons of subsections of phonology, semantics and syntax were performed and are depicted in tables 4.14 and 4.15.

The results of Mann-Whitney U test indicated a significant difference for the subsections of phonemic discrimination and total phonology under the domain of phonology, and lexical category and homonymy under the domain of semantics between the ML and BL groups of CWNS. Further analysis revealed that ML CWNS performed better than BL CWNS on these subsections. On comparing ML and BL CWS, results of Mann-Whitney indicated that phonemic discrimination and total phonology under the main section of phonology, and lexical category, synonymy, homonymy, syntagmatic relations, semantic contiguity, and semantic similarity under the domain of semantics differed significantly. In-depth analysis revealed that comparable to the results obtained for ML and BL CWNS, ML CWS outperformed their bilingual peers on the subsections of phonemic discrimination, total phonology, lexical category, and homonymy. However, it was observed that the BL CWS exhibited better scores on the subsections of semantics such as synonymy, syntagmatic relations, semantic contiguity, and semantic similarity.

Table 4.14
Results of Mann Whitney U test for subsections of Phonology and Semantics (LPT) across ML and BL CWS and CWNS

Subsections of Phonology and Semantics	ML and BL CWS		ML and BL CWNS	
	|z|	p	|z|	p
Phonemic Discrimination	3.10	**0.00***	3.92	**0.00***
Phonetic Expression	0.00	1.00	0.00	1.00
Total Phonology	3.10	**0.00***	3.77	**0.00***
Semantic Discrimination	0.00	1.00	0.00	1.00
Naming	0.00	1.00	0.00	1.00
Lexical Category	2.47	**0.01***	4.25	**0.00***
Synonymy	2.95	**0.00***	0.00	1.00
Antonymy	0.56	0.57	1.46	0.14
Homonymy	2.79	**0.00***	4.73	**0.00***
Polar Questions	1.14	0.52	1.43	0.15
Semantic Anomaly	1.63	0.10	0.41	0.67
Paradigmatic Relations	0.24	0.80	0.57	0.56
Syntagmatic Relations	2.47	**0.01***	0.37	0.70
Semantic Contiguity	2.60	**0.00***	1.76	0.07
Semantic Similarity	3.68	**0.00***	1.34	0.17
Total Semantics	0.63	0.52	0.04	0.96

Note. *= significant at 0.05 level.

On comparison of the subsections of syntax across ML and BL CWNS, a significant difference was found to exist in the sections such as plural forms, PNG markers, case marker, transitives, intransitives, and causatives, predicates, conjunctions, comparatives and quotatives. Results revealed that ML CWNS performed better when compared to BL CWNS. The results of Mann-Whitney U test indicated a significant difference only for the subsection of participle constructions, with BL CWS performing better than ML CWS.

Table 4.15
Results of Mann Whitney U test for subsections of Syntax (LPT) across ML and BL CWS and CWNS

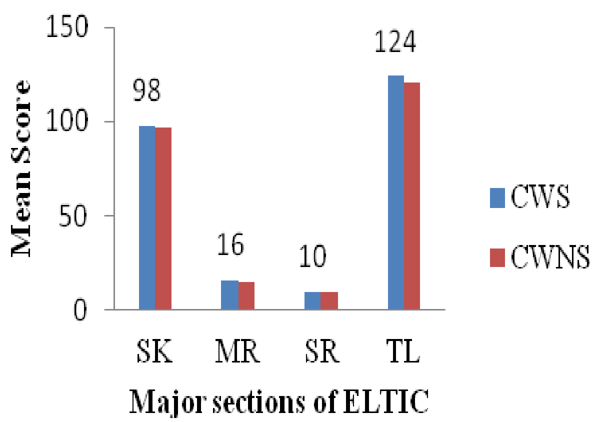
Subsections of Syntax	ML and BL CWS		ML and BL CWNS	
	|z|	p	|z|	p
Morphophonemic Structures	0.81	0.41	0.03	0.97
Plural Forms	0.37	0.71	2.95	**0.00***
Tenses	0.24	0.81	1.77	0.07
Person Number Gender Markers	0.16	0.86	3.11	**0.00***
Case Markers	0.39	0.69	2.02	**0.04***
Transitives, Intransitives, and Causatives	1.62	0.10	1.96	**0.05***
Sentence Types	1.60	0.11	0.06	0.95
Predicates	0.76	0.44	2.57	**0.01***
Conjunctions, Comparatives and Quotatives	0.43	0.66	2.32	**0.02***
Conditional Clauses	1.19	0.23	1.15	0.24
Participle Constructions	2.23	**0.02***	0.21	0.82
Total Syntax	1.08	0.27	1.52	0.12
Total Language	0.93	0.35	1.44	0.15

Note. *= significant at 0.05 level.

To summarize, ML CWS outperformed their bilingual peers on the subsections of phonemic discrimination, total phonology, lexical category, and homonymy. It was further observed that the BL CWS exhibited better scores on the subsections of semantics such as synonymy, syntagmatic relations, semantic contiguity, semantic similarity, and participle constructions under the section of syntax. Overall, mixed findings were observed for ML and BL CWS across the various subsections of LPT. On the other hand, ML CWNS performed better than BL CWNS on the subsections of phonemic discrimination, total phonology, lexical category, homonymy, plural forms, PNG markers, case markers, transitives, intransitives, and causatives, predicates, conjunctions, comparatives and quotatives. Results seem to suggest that ML CWNS consistently exhibited higher scores on certain subsections of the LPT than BL CWNS.

4.2.2. Comparison of language abilities of BL CWS and CWNS based on results of ELTIC

The data analyses of the main section of ELTIC (English language test for Indian children) domains such as syntax, semantics and total language were compared between the CWS and age and gender matched CWNS. The comparisons of subsections of the ELTIC domains included body parts, nouns, verbs, categories, functions, prepositions, colours and quantity, opposites, total reception, total expression, total semantic knowledge (semantics), pronouns, verb tenses, plurals, total morphological rules, subject-verb agreement, negation, sentence repetition, judgment of correctness, total syntactic rules (syntax) and total language score. The language abilities based on ELTIC results were analyzed only for BL (25) and in 2 groups, CWS and CWNS. Figure 4.3 illustrates the major sections of ELTIC for both groups of CWS and CWNS.



Note. SK = Semantic knowledge, MR = Morphological rules, SR = Syntactic rules, TL = Total language.

Figure 4.3. Major sections of ELTIC in BL CWS and CWNS groups.

The mean scores of the main and subsection of ELTIC domains such as syntax, semantics and total language were analyzed and compared between BL CWS and CWNS. The summary of Figure 4.3 revealed that the performance in major sections of ELTIC was slightly higher in BL CWS compared to CWNS, though not statistically significant. Table 4.16 illustrates the mean scores and standard deviation for main and subsections ELTIC in the BL CWS and CWNS respectively. Comparisons of the subsections of ELTIC suggested that BL CWS performed slightly better on a majority of the subsections, with the exception of nouns, categories, colours and quantity. However, these differences were not found to be significantly different.

Table 4.16

Mean and SD of subsections of ELTIC in BL CWS and CWNS

Subsections of ELTIC	CWNS		CWS	
	M	SD	M	SD
Body parts- R	7.88	0.97	8.00	1.11
Body parts- E	6.16	0.98	6.72	1.17
Nouns- R	8.16	0.85	8.04	0.84
Nouns- E	5.92	1.25	6.32	1.18
Verbs- R	7.56	1.00	7.52	1.22
Verbs- E	6.20	0.95	6.24	1.09
Categories- R	7.60	0.86	7.24	0.83
Categories- E	6.20	1.11	5.96	1.05
Functions- R	6.64	0.81	6.88	0.92
Functions- E	4.56	0.96	5.00	1.22
Prepositions- R	6.64	1.38	6.60	1.11
Prepositions- E	4.04	1.36	4.32	1.18
Colours and Quantity - R	7.68	1.06	7.44	0.82
Colours and Quantity - E	6.88	1.20	6.80	0.64
Opposites	5.12	1.16	5.56	1.41
Total Reception	52.1	5.43	51.8	5.78
Total Expression	45.20	7.64	46.77	7.72
Semantic knowledge	97.36	12.83	98.24	13.38
Pronouns	5.40	1.77	6.08	1.18
Verb tenses	5.44	1.66	5.32	1.37
Plurals	3.96	1.09	4.48	1.29
Morphological rules	14.80	4.15	15.92	3.55
Subject verb	4.32	1.28	4.24	1.16
Sentence repetition	5.44	0.86	5.76	0.96
Syntactic rules	9.76	1.73	10.00	1.97
Language score	121.90	18.14	124.00	18.42

Note. R = reception, E = expression.

The Mann-Whitney U test results indicated no significant difference for the major sections of ELTIC across BL CWS and CWNS. Table 4.17 displays the results of Mann Whitney U test for ELTIC across BL children for both groups. To conclude, the data corpus related to language measures suggested an identical performance in CWS and CWNS for the English language.

Table 4.17
Results of Mann Whitney U test for ELTIC across BL CWS and CWNS

Major sections of ELTIC	BL CWS and CWNS	
	|z|	p
Total reception	0.32	0.74
Total expression	0.28	0.77
Semantic knowledge	0.04	0.96
Morphological rules	1.16	0.24
Syntactic rules	0.38	0.69
Total language	0.36	0.71

4.3. Stuttering severity and language abilities in children with stuttering

The language abilities of CWS were analyzed using the standardized test such as Linguistic profile test (LPT; Karanth et al., 1991) in Kannada and English language test for Indian children (ELTIC, Bhuvaneswari & Jayashree, 2011). The data analyses of the main sections of LPT and ELTIC on domains such as phonology, syntax, semantics, and total language were compared across degrees of severity in ML and BL CWS. However, comparison of the group of CWS with mild stuttering was not undertaken due to limited number of participants in this group (ML = 0, BL= 2).

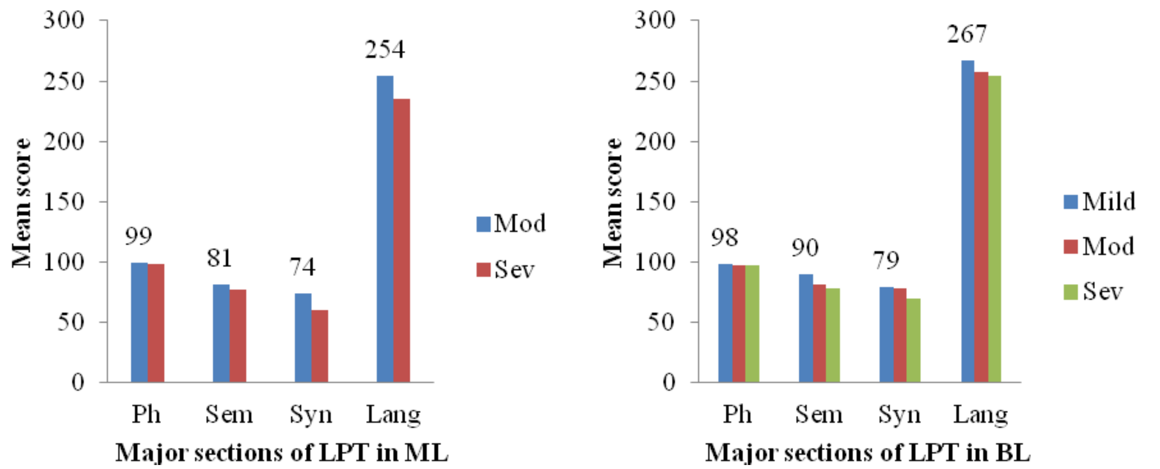
4.3.1. Comparison of language abilities using LPT across severity in ML CWS

The mean scores of the main section of LPT domains such as phonology, syntax, semantics and language were analyzed and compared across degrees of severity in ML CWS. Table 4.18 illustrate the mean raw scores and standard deviation for main sections of LPT across degrees of severity in the ML and BL CWS. Comparisons across the LPT suggested that ML CWS having a moderate degree of stuttering consistently scored higher on all the major sections of the LPT than children with a severe degree of stuttering. Figure 4.4 illustrates the mean scores of the major sections of LPT across severity of stuttering.

Table 4.18

Mean and SD of major sections of LPT across severity in ML and BL CWS

Major sections of LPT	ML				BL					
	Moderate		Severe		Mild		Moderate		Severe	
	M	SD	M	SD	M	SD	M	SD	M	SD
Phonology	98.51	1.47	97.75	1.28	97.50	0.70	96.93	1.86	96.75	1.38
Semantics	81.37	7.66	77.43	8.47	89.75	2.47	81.86	7.95	78.37	5.12
Syntax	73.98	14.68	59.75	12.11	79.25	3.88	78.20	10.77	69.93	8.88
Language	253.87	22.10	235.00	17.65	266.50	5.65	257.00	19.05	245.06	13.78



Note. Ph = Phonology, Sem = Semantics, Syn = Syntax, Lang = Language, ML = monolingual, BL = bilingual.

Figure 4.4. Mean scores of the major sections of LPT across severity of stuttering.

Table 4.19

Results of Mann Whitney U test for LPT across severity in ML and BL CWS

LPT Domains	MLK		BLK	
	|z|	p	|z|	p
Total Phonology	1.37	0.17	0.65	0.51
Total Semantics	1.18	0.23	1.13	0.25
Total syntax	2.49	**0.01***	1.87	0.06
Total Language	2.08	**0.03***	1.35	0.17

Note. MLK = monolingual Kannada, BLK = bilingual Kannada.

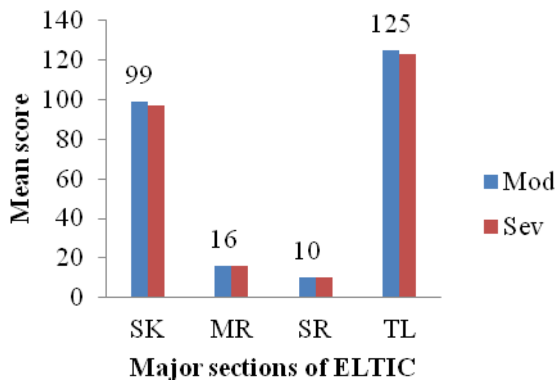
Results of Mann-Whitney U test in ML CWS (table 4.19) indicated a significant difference on the major sections of total syntax and overall language across degrees of severity (moderate and severe). Detailed analysis indicated that ML children having a moderate degree of stuttering performed better on these sections than children with a severe degree of stuttering. However, no significant difference was noted on the sections of total phonology and total semantics; indicating that both groups of children performed on par with each other on these sections.

4.3.2. Comparison of language abilities using LPT in BL CWS

The mean scores of the main section of LPT domains such as phonology, syntax, semantics and language were analyzed and compared across degrees of severity in BL CWS (Kannada). Table 4.18 illustrates the mean raw scores and standard deviation for main sections of LPT across degrees of severity in BL CWS. The results show that CWS having a mild degree of stuttering consistently scored higher on all the major sections of LPT than BL children with either a moderate or severe degree of stuttering. Additionally, children with moderate stuttering severity outperformed the children with severe stuttering on all major sections of LPT. It can be inferred that children with mild stuttering obtained the highest scores on the LPT, while children with severe stuttering demonstrated the poorest scores; though not statistically significant. Table 4.19 displays the results of Mann Whitney U test for LPT in BL children for both groups, which indicated no significant difference for the major sections of LPT across severity (moderate and severe) in BL CWS (Kannada).

4.3.3. Comparison of language abilities using ELTIC across severity in BL CWS

The main and subsection of ELTIC domains such as syntax, semantics and total language were analyzed and compared across degrees of severity (moderate and severe) in BL CWS in English language. Table 4.20 illustrates the mean scores and standard deviation for main sections of ELTIC across severity in the BL CWS. Figure 4.5 illustrates the language abilities based on ELTIC scores across degree of stuttering.



Note. SK = Semantic knowledge, MR = Morphological rules, SR = Syntactic rules, TL = Total language.

Figure 4.5. Language abilities based on ELTIC across degree of stuttering.

Table 4.20

Mean and SD of major sections of ELTIC across severity in BL CWS

Major sections of ELTIC	BL CWS			
	Moderate		Severe	
	M	SD	M	SD
Total Reception	52.25	5.73	51.00	6.14
Total Expression	46.87	7.24	45.66	8.91
Semantic Knowledge	99.12	12.77	96.66	14.79
Morphological Rules	15.87	03.53	16.00	03.80
Syntactic Rules	09.93	02.20	10.11	01.61
Total Language	124.68	18.61	122.77	19.13

Comparisons of the major sections of ELTIC suggested that BL CWS having a moderate degree of stuttering consistently scored higher on all the major sections of the ELTIC than BL children with severe stuttering; though not significant.

Table 4.21

Results of Mann-Whitney U test for ELTIC across severity in BL CWS

Major sections of ELTIC	BLE	
	|z|	p
Total reception	0.68	0.49
Total expression	0.36	0.71
Semantic knowledge	0.56	0.57
Morphological rules	0.17	0.86
Syntactic rules	0.29	0.77
Total language	0.56	0.57

The Mann-Whitney U test results indicated no significant difference for the major sections of ELTIC across severity (moderate and severe) in BL CWS. Table 4.21 displays the results of Mann Whitney U test for ELTIC across BL children for both groups. The data corpus related to language measures suggested an identical performance in BL CWS having moderate and severe degrees of stuttering for the English language.

To summarize, the language abilities in Kannada language measured on LPT indicated that ML CWS with moderate degree of stuttering performed better on total syntax and total language than children with a severe degree of stuttering. However, such differences were not found in BL CWS between degrees of stuttering in Kannada language. In addition, the analyses of second language abilities in English as measured on ELTIC also indicated no significant differences across severity.

4.4. Linguistic determinants of disfluencies

The influences of linguistic variables in CWS were investigated in the present study. Linguistic aspects of stuttering included the analysis of the loci and frequency of stuttered events related to the phonetic, morphological and syntactic components of language in both ML and BL CWS and across languages, Kannada and English. The results are provided below under heads of phonetic, morphological and syntactic determinants.

4.4.1. Phonetic determinants of disfluencies

The phonetic influences investigated the frequencies of occurrence of disfluent phonemes with regard to total consonants, total vowels, voiced and unvoiced consonants, clusters, and disfluent consonants based on place and manner of articulation. The following sections provide the description of results obtained for phonetic determinants of disfluencies.

4.4.1.1. Disfluent phonemes

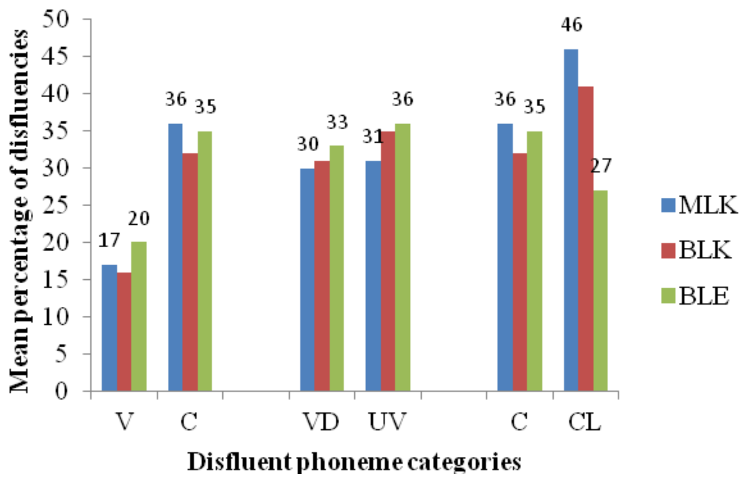
The frequencies of occurrence of disfluent phoneme categories in ML and BL CWS within and across languages were analyzed. The mean percentage of disfluent phoneme categories was calculated by considering the ratio of the total number of times the specific disfluent phoneme category occurred to the total number of times that specific phoneme category occurred in the speech sample, multiplied by 100. The analysis of the mean percentage of disfluent phoneme categories was restricted to only those phonemes that occurred in the initial position of words. Table 4.22 illustrates the mean percentage, median percentage and standard deviation for disfluent phoneme categories across the groups. As the standard deviation was high for few phoneme types, the median percentage scores are also included in the table.

Table 4.22

Mean, SD and Median of percent disfluencies in phoneme categories across groups

Disfluent phoneme categories	MLK				BLK				BLE			
	N	Mean	SD	Median	N	Mean	SD	Median	N	Mean	SD	Median
Vowels	35	16.82	07.83	16.00	25	16.52	08.39	16.00	25	19.64	10.59	18.00
Consonants	35	35.57	18.28	32.00	25	32.04	08.94	30.00	25	34.64	11.10	36.00
Voiced	35	30.00	12.52	29.00	25	31.16	08.82	31.00	25	33.00	13.74	32.00
Unvoiced	35	30.54	12.69	28.00	24	34.79	11.83	33.50	25	35.60	09.89	37.00
Clusters	30	45.50	20.15	42.00	24	40.54	18.64	40.00	25	27.16	13.63	25.00

Note. MLK = monolingual Kannada, BLK = bilingual Kannada, BLE = bilingual English.



Note. V= Vowels, C= Consonants, VD= Voiced, UV= Unvoiced, CL= Clusters, MLK= monolingual Kannada, BLK= bilingual Kannada, BLE= bilingual English.

Figure 4.6. Mean percentage scores for disfluent phoneme categories across groups.

4.4.1.1.1. Consonants and Vowels

The mean percentage of disfluent consonants was calculated by considering the ratio of the total number of times the consonants were disfluent to the total number of consonants that occurred in the speech sample, multiplied by 100. The mean percentage of disfluent consonants were found to be 36%, 32% and 35% in ML and BL (Kannada and English languages) respectively. Similarly, the mean percentage of disfluent vowels was calculated by considering the ratio of the total number of times the vowels were disfluent to the total number of vowels that occurred, multiplied by 100. The mean percentages of disfluent vowels were found to be 17%, 17% and 20% in ML and BL (Kannada and English languages) respectively (Table 4.22). The results of Mann-Whitney U test revealed no significant difference, for the occurrence of disfluent vowels and disfluent consonants across groups (ML and BL CWS). The results suggested a similar trend for the occurrence of disfluent vowels and consonants in both the groups. Table 4.23 illustrates the results of non-parametric tests for the comparison of disfluent consonants and vowels.

Table 4.23
Results of non-parametric tests for disfluent consonants, vowels and clusters

Groups/ Disfluent phoneme categories	MLK		BLK		BLE		Phoneme categories	BLK and BLE		MLK and BLK	
	|z|	P	|z|	p	|z|	P		|z|	p	|z|	p
Vowels & Consonants	4.60	0.00**	4.34	0.00**	4.16	0.00**	Vowels	1.33	0.18	0.17	0.86
Consonants & Clusters	2.51	0.01*	2.02	0.04*	2.54	0.01*	Consonants	0.77	0.44	0.16	0.86
							Clusters	2.55	0.01*	0.70	0.48

Note. MLK= monolingual Kannada, BLK= bilingual Kannada, BLE= bilingual English, ** = highly significant, * = significant at 0.05 level.

In the ML group, Wilcoxon signed rank test revealed significant difference for the occurrence of disfluent vowels and consonants. The results of this analysis suggested that the mean percentage of disfluent consonants was significantly higher than disfluent vowels (Table 4.23 & Figure 4.7). In the BL group, Wilcoxon signed rank test was used to compare the frequency of disfluent consonants and vowels in both the languages. The results showed significant difference for disfluent vowels and consonants in Kannada and English languages. The results suggested that the BL group showed a similar trend as ML group which indicated an increased occurrence of disfluent consonants compared to vowels.

Overall, the results suggest that the frequency of occurrence of disfluent consonants was significantly higher compared to disfluent vowels in ML and BL CWS. Also, within the BL group, disfluent consonants occurred significantly higher in both the languages compared to vowels indicating the presence of similar pattern across languages.

4.4.1.1.2. Consonants and Clusters

The mean percentage of disfluent consonants were found to be 36%, 32% and 35% in ML and BL (Kannada and English languages) respectively. Similar to disfluent consonants, the mean percentage of disfluent clusters was calculated by considering the ratio of the total number of times the clusters were disfluent to the total number of clusters that occurred in the speech sample, multiplied by 100. The mean percentages of disfluent clusters were found to be 46%, 41% and 27% in ML and BL (Kannada and English languages) respectively (Table 4.22).

While comparing both the ML and BL groups, the results of Mann-Whitney U test revealed no significant difference for the occurrence of disfluent consonants and clusters. The results revealed a similar pattern in disfluent consonants and clusters across groups in CWS. Table 4.23 illustrates the results of non-parametric tests for the comparison of disfluent consonants and clusters. Wilcoxon signed rank test was used to compare the frequency of disfluent consonants and clusters within the ML and BL groups. A significant difference was found between the occurrence of disfluent clusters and consonants. The results of this analysis suggested that the mean percentage of disfluent clusters was significantly higher than disfluent consonants in both ML and BL groups in Kannada language.

Considering the BL group, Wilcoxon signed rank test was used to compare the frequency of disfluencies across languages and categories. The results showed significant difference for disfluent clusters between languages suggesting that the mean percentage of disfluent clusters was significantly higher in Kannada than English language. However, significant difference was not found for disfluent consonants, suggesting a similar trend between languages. Figure 4.6 provides mean percentages of consonants and clusters across groups and languages.

Overall, the results suggest that the frequency of occurrence of disfluent clusters and consonants were not significantly different in ML and BL group indicating a similar trend in both the groups. It was found that the disfluent clusters were significantly higher than disfluent consonants in both the groups in Kannada language. Considering the BL group, the results indicated significant increase of disfluent clusters in Kannada compared to English. However, there was no significant difference between the languages for disfluent consonants indicating the presence of similar trend across languages.

4.4.1.1.3. Voiced and Unvoiced Consonants

The disfluent voiced and unvoiced consonants were calculated by considering the ratio of the total number of times these consonants were disfluent to the total number of voiced/unvoiced consonants that occurred in the speech sample, multiplied by 100. Table 4.22 depicts the frequency of occurrence of disfluent voiced and unvoiced consonants in ML and BL group. Figure 4.6 provides mean percentages of voiced and unvoiced consonants across groups and languages. Mixed ANOVA was administered to study the main and interaction effects of the groups (ML and BL) and categories (voiced and unvoiced consonants). According to the analysis there was significant main effect of categories, but there was no significant main effect of groups and interaction between groups and categories (Table 4.24).

Table 4.24

Results of mixed ANOVA for the effect of the groups and categories (VD & UV)

Particulars	F (1, 57)	Sig.	p value
ML and BL groups	0.81	0.36	>0.05
Categories	5.10	0.02	**<0.05****
Groups*categories	2.79	0.10	>0.05

Note. ML = monolingual, BL = bilingual, VD = voiced, UV = unvoiced, * = interaction of groups and categories, ** = significant at 0.05 level.

Though the main effect of categories was observed in mixed ANOVA, the analyses using paired t- test within each group suggested that the differences between voiced and unvoiced consonants were obtained only for BL Kannada group [t (23) =

2.00, $p < 0.05$]. The results confirmed the occurrence of disfluent unvoiced consonants to be greater compared to voiced consonants only in BL Kannada group. However, the paired t-test for comparison of categories (voiced and unvoiced consonants) revealed no significant difference for other groups (ML, BLE). Similarly, significant difference was not found for disfluent voiced and unvoiced consonants across languages in the BL group. These results suggest that both categories of consonants behaved in a similar manner in majority of CWS. Table 4.25 illustrates the results of paired t-test across disfluent voiced and unvoiced consonants.

Table 4.25
Results of paired t-test across disfluent voiced and unvoiced consonants

Comparisons	Parameters	MLK	BLK	BLE	BLK & BLE (VD)	BLK & BLE (UV)
Voiced and Unvoiced	t	0.60	2.00	1.34	0.59	0.42
	df	34	23	24	24	23
	p	0.55	**0.05***	0.19	0.55	0.67

Note. MLK= monolingual Kannada, BLK= bilingual Kannada, BLE= bilingual English, VD = voiced, UV = unvoiced, * = significant at 0.05 level.

Overall, the results suggest that the frequency of occurrence of disfluent unvoiced consonants occurred significantly higher than voiced consonants only in BL Kannada group of CWS. However, the other groups exhibited no significant difference between disfluent voiced and unvoiced consonants. Also, a similar trend was observed in the BL group across Kannada and English languages. This suggested the existence of a similar pattern among majority of children under study.

4.4.1.1.4. Disfluent consonants based on place of articulation

The mean percentage of disfluent consonant categories based on place of articulation was calculated by considering the ratio of the total number of times these consonant categories were disfluent to the total number of times that specific consonant category occurred in the speech sample, multiplied by 100. The data analysis considering the place of articulation included categories such as velars, retroflex, dentals, labials, palatals, glottal and alveolars. Table 4.26 depicts the descriptive scores of the categories among ML and BL CWS. The classification of disfluent phonemes based on place of articulation in Kannada and English languages are mentioned as described by Upadhyaya (2000) respectively.

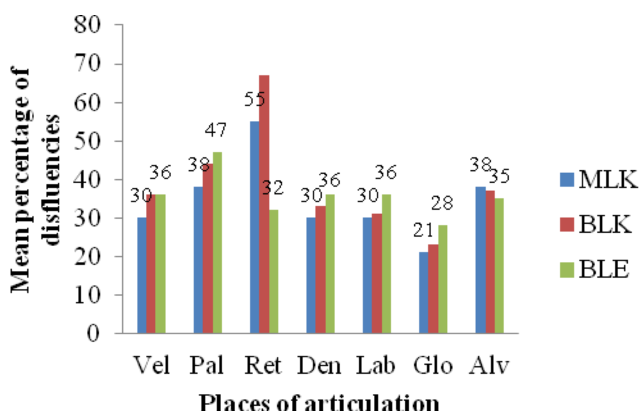
Table 4.26
Mean, SD and Median of percent disfluent phoneme categories considering place of articulation

Disfluent phoneme categories	MLK				BLK				BLE			
	N	Mean	SD	Median	N	Mean	SD	Median	N	Mean	SD	Median
Velars	35	30.45	13.59	28.00	25	35.92	12.43	36.00	25	35.52	13.20	38.00
Palatals	35	37.77	15.50	35.00	24	44.25	19.19	42.50	25	47.16	21.89	44.00
Retroflex	34	55.38	25.57	50.00	22	67.27	25.33	66.00	23	32.17	16.68	28.00
Dentals	35	29.57	15.68	27.00	25	33.28	11.27	33.00	25	36.12	18.71	36.00
Labials	35	29.60	13.17	27.00	25	30.96	10.85	28.00	25	35.80	12.01	44.00
Glottal	33	21.42	15.46	18.00	25	23.28	18.68	20.00	25	27.68	28.15	19.00
Alveolars	35	38.37	20.33	32.00	24	37.33	11.69	35.00	25	34.68	12.38	36.00

Note. MLK= monolingual Kannada, BLK= bilingual Kannada, BLE= bilingual English.

a. Comparison of consonant categories across ML and BL CWS

Table 4.26 and Figure 4.7 display the mean percentage of disfluent consonant categories across ML and BL CWS with respect to place of articulation.



Note. Vel= velars, Pal= palatals, Ret= retroflex, Den= dentals, Lab= labials, Glo= glottal, Alv= alveolars, MLK= monolingual Kannada, BLK= bilingual Kannada, BLE= bilingual English.

Figure 4.7. Mean percent of disfluencies considering places of articulation across groups.

The nonparametric Mann-Whitney U test was used to compare the occurrence of disfluent consonants with regard to the place of articulation in Kannada language between groups (ML and BL CWS), which revealed no significant difference (Table 4.27). Specifically, the values for the variables in question did not vary in both the groups. These results reveal a similar trend for categories with regard to their place of articulation in Kannada language across groups.

Table 4.27

Results of Mann-Whitney U test with respect to place of articulation for both groups

Categories	MLK & BLK	
	|z|	p
Velars	1.62	0.10
Palatals	1.28	0.19
Retroflex	1.69	0.09
Dentals	1.60	0.10
Labials	0.78	0.43
Glottal	0.47	0.63
Alveolars	0.58	0.55

Note. MLK= monolingual Kannada, BLK= bilingual Kannada.

b. Comparison of consonant categories within ML CWS

Table 4.26 and Figure 4.7 display the mean percentage of disfluent consonant categories within ML CWS with respect to place of articulation. The Friedman test, a non-parametric test, was administered for within group comparison of the categories of consonants according to their places of articulation in ML. The results revealed significant difference [$\chi^2(6) = 87.12$, $p < 0.05$] for the categories with respect to place of articulation. To determine the pair-wise comparisons between the categories in ML, a non-parametric test, the Wilcoxon signed rank test was used. Table 4.28 illustrates the summary of the various comparisons performed, considering place of articulation. The findings revealed significant difference across velars in comparison to palatals, retroflex, glottal and alveolars; across palatals in comparison to retroflex, dentals, labials and glottal; across retroflex in comparison to dentals, labials, glottal and alveolars; across dentals and labials in comparison to glottal and alveolars; and alveolars with respect to glottal.

Table 4.28

Results of Wilcoxon signed rank test for places of articulation in ML group

Categories	Retroflex		Dentals		Labials		Glottal		Alveolars		Velars	
	|z|	p	|z|	p	|z|	p	|z|	p	|z|	P	|z|	p
Palatals	3.72	**0.00***	3.95	**0.00***	4.12	**0.00***	4.73	**0.00***	0.03	0.97	2.99	**0.00***
Retroflex	-	-	4.06	**0.00***	4.49	**0.00***	4.39	**0.00***	3.46	**0.00***	4.29	**0.00***
Dentals	-	-	-	-	0.70	0.48	2.85	**0.00***	3.32	**0.00***	1.12	0.26
Labials	-	-	-	-	-	-	3.18	**0.00***	3.64	**0.00***	0.81	0.41
Glottal	-	-	-	-	-	-	-	-	4.38	**0.00***	2.90	**0.00***
Alveolars	-	-	-	-	-	-	-	-	-	-	3.32	**0.00***

Note. *= significance at 0.01 level.

To summarize the findings obtained in the ML group of CWS, velars were significantly lower compared to palatals, retroflex and alveolars, but significantly higher than glottal consonant. Palatals were significantly higher when compared against dentals, labials and glottal but not so for retroflex. Retroflex were significantly higher compared to dentals, labials, glottal and alveolars. Dentals and labials were significantly lower with respect to alveolars, but significantly higher when compared against glottal. Alveolars were significantly higher when compared to the glottal. Considering the mean percentage of the frequency of occurrence of the disfluent consonants according to place of articulation, from most frequent to least frequent are as follows: retroflex, alveolars, palatals, velars, labials, dentals and glottal. It can be concluded that retroflex sounds were the most disfluent category of consonants while the glottal was the least disfluent in ML CWS.

c. *Comparison of consonant categories within BL CWS*

Among the BL group, the analysis of one way repeated measures ANOVA revealed a significant difference across the categories considering place of articulation in Kannada language [$F (5, 100) = 19.80$; $p <0.05$]. The adjusted Bonferroni's multiple comparisons test was conducted for pair-wise comparisons between the categories. Further, pair-wise comparisons of velars in comparison to retroflex sounds; palatals in comparison to labials; retroflex in comparison to dentals, labials, and alveolars suggested significance at 0.05 level. However, since the glottal category of place of articulation did not show normality, non-parametric Wilcoxon signed rank test was administered. The results suggest that the glottal group differed significantly compared to velars ($|z| = 3.66$;

p <0.05), palatals (|z| = 3.57; p <0.05), retroflex (|z| = 3.57; p <0.05), dentals (|z| = 3.14; p <0.05), labials (|z| = 2.88; p <0.05) and alveolars (|z| = 3.40; p <0.05). It can be inferred that the retroflex category was significantly higher compared to all other categories except the palatals while the glottal category was significantly lower as against all other categories. The frequency of occurrence of disfluent consonants according to place of articulation, from most frequent to least frequent are as follows: retroflex, palatals, alveolars, velars, dentals, labials and glottal. It can be concluded that retroflex were the most disfluent category of consonants while the glottal was the least disfluent in BL CWS for Kannada language. Table 4.26 and Figure 4.7 display the mean percentage of disfluent consonant categories within BL CWS with respect to place of articulation.

The analysis using one way repeated measures ANOVA revealed a significant difference across the categories considering place of articulation in English language [F (4, 96) = 4.98; p <0.05]. Further, (adjusted Bonferroni's multiple comparisons test) pair-wise comparisons across palatals in comparison to velars, labials, and alveolars were seen to be significant at 0.05 level. It can be inferred that the palatals was significantly higher as compared to all the 3 categories mentioned above. The non-parametric Wilcoxon signed rank test results revealed a significant difference between palatals in comparison to retroflex (|z| = 2.87; p <0.05) and glottal (|z| = 2.16; p <0.05) in English for the BL CWS. This indicates that the palatal was significantly higher compared to the other 2 categories.

The rank order of disfluent consonants according to places of articulation for English in BL, from most frequent to least frequent were as follows: palatals, dentals, labials, velars, alveolars, retroflex, and glottal. It can be concluded that palatals were the most disfluent category of consonants while the glottal was the least disfluent in BL CWS for English language. Figure 4.7 displays the mean percentage of various places of articulation across groups.

Similarly, the paired t-test was adopted to analyze categories of place of articulation, across languages in BL CWS. Table 4.29 displays the results of paired t-test for places of articulation across languages in BL group. Results suggested no significant difference across the categories, indicating that a similar pattern existed between the disfluent consonants across both languages with regard to place of articulation. However, the results of Wilcoxon signed rank test for the comparison of the retroflex category indicated a significant difference ($|z| = 3.07$; $p < 0.05$) across Kannada and English. Further analysis revealed that retroflex in Kannada language was significantly more disfluent than in English.

Table 4.29
Results of paired t-test across languages in BL CWS

Phoneme categories based on place of articulation	t	df	p
Velars	0.13	24	0.89
Palatals	0.60	23	0.55
Dentals	0.73	24	0.47
Labials	1.69	24	0.10
Glottal	1.50	21	0.14
Alveolars	0.32	24	0.75

Overall, the results suggest that the frequency of occurrence of disfluent consonants considering place of articulation revealed a similar trend across both groups in Kannada language. Among BL group however, the rank order of categories varied with regard to place of articulation and the results suggested no significant difference, with the exception of retroflex across both languages. Additionally, the glottal category was least disfluent in all 3 groups of CWS.

4.4.1.1.5. Disfluent consonants based on manner of articulation

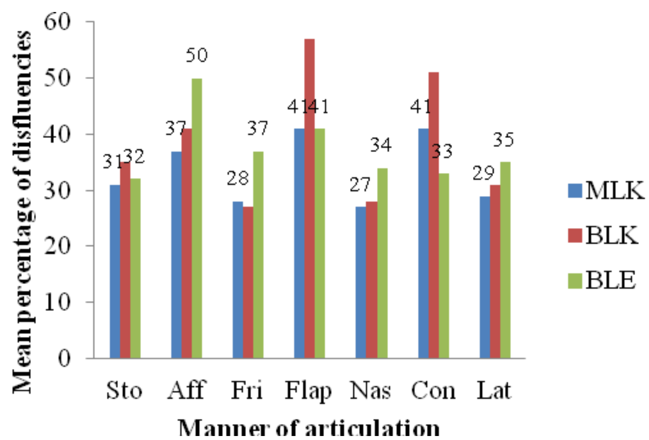
The mean percentage of disfluent consonant categories based on manner of articulation was calculated by considering the ratio of the total number of times these consonant categories were disfluent to the total number of times that specific consonant category occurred in the speech sample (with respect to manner of articulation), multiplied by 100. The data analysis concerning the manner of articulation included categories such as: stops, affricates, fricatives, continuants, flap, nasals, and laterals. Table 4.30 represents the mean percentage scores of these categories based on manner of articulation among ML and BL CWS. The classification of disfluent phonemes based on manner of articulation for Kannada and English languages mentioned are as described by Upadhyaya (2000).

Table 4.30

Mean, SD and Median of percent disfluent phonemes considering manner of articulation

Disfluent phoneme categories	MLK				BLK				BLE			
	N	M	SD	Med	N	M	SD	Med	N	M	SD	Med
Stops	35	31.48	12.97	29.00	25	35.00	9.92	34.00	25	31.66	10.64	32.00
Affricates	35	37.31	16.56	37.00	24	40.50	20.18	39.50	25	49.57	20.82	50.00
Fricatives	35	28.02	15.08	24.00	25	27.40	9.81	25.00	25	36.90	12.75	38.00
Flap	29	41.00	17.92	33.00	22	57.45	18.65	53.50	25	40.71	16.03	40.0
Nasals	35	27.11	13.48	23.00	25	28.32	10.50	26.00	25	33.66	11.04	35.00
Continuants	33	40.84	16.08	35.00	23	51.26	17.56	50.00	15	33.46	29.55	29.00
Laterals	10	29.11	10.07	25.00	12	31.30	14.74	29.00	24	34.66	14.29	34.50

Note. MLK = monolingual Kannada, BLK = bilingual Kannada, BLE = bilingual English, M = Mean, Med = Median.



Note. Sto= stops, Aff= affricates, Fri= fricatives, Nas= nasals, Con= continuants, Lat= laterals, MLK= monolingual Kannada, BLK= bilingual Kannada, BLE= bilingual English.

Figure 4.8. Mean percentages of disfluencies considering manner of articulation in CWS.

a. Comparison of ML and BL CWS

Table 4.30 and Figure 4.8 represent the mean percentage scores of disfluent consonant categories with respect to manner of articulation among ML and BL CWS. Non-parametric Mann-Whitney U test was employed to compare the categories with respect to manner of articulation across ML and BL CWS for Kannada language. Table 4.31 illustrates the results of Mann-Whitney U test with respect to manner of articulation for both groups. The results revealed significant difference for flap and continuants and remaining categories did not show significant difference. This implies that only flap and continuants presented significantly varied pattern, while stops, affricates, fricatives and nasals showed almost similar pattern between groups. It was noted that the BL group had significantly higher score for flap and continuants compared to ML group.

Table 4.31
Results of Mann-Whitney U test with respect to manner of articulation for both groups

Categories	MLK & BLK	
	|z|	p
Stops	1.35	0.17
Affricates	0.46	0.62
Fricatives	0.49	0.62
Flap	3.35	**0.00***
Nasals	0.83	0.40
Continuants	2.38	**0.01***
Lateral	0.38	0.59

Note. * = significance at 0.05 level, MLK= monolingual Kannada, BLK= bilingual Kannada.

b. Comparison of consonant categories within ML CWS

Table 4.30 and Figure 4.8 represent the mean percentage scores of disfluent consonant categories with respect to manner of articulation within ML CWS. The Friedman non-parametric test was administered for within group comparison of the categories of consonants according to their manner of articulation in ML. The results revealed significant difference [$\chi^2(5) = 69.73$, $p < 0.05$] across the categories in ML CWS.

The non-parametric Wilcoxon signed rank test results revealed significant difference, for the occurrence of disfluent consonants with regard to the manner of articulation in ML CWS for majority of the pairs. The results of this analysis revealed significant difference across stops in comparison to affricates, fricatives, laterals, flap, nasals, and continuants; across fricatives and laterals in comparison to affricates, flap, continuants; across nasals in comparison to affricates, flap and continuants. Table 4.32 depicts the results of Wilcoxon signed rank test with respect to manner of articulation in ML. In summary, stops were significantly lower when compared to affricates, flap and continuants, while it was significantly higher than fricatives, laterals and nasals. The fricatives, laterals and the nasal categories were significantly lower compared to affricates, flap and continuants.

Table 4.32

Results of Wilcoxon signed rank test with respect to manner of articulation in ML CWS

Categories	Stops		Affricates		Fricatives		Flap		Nasals		Continuants	
	|z|	p	|z|	p	|z|	p	|z|	p	|z|	p	|z|	p
Stops	-	-	2.91	**0.00***	-	-	-	-	-	-	-	-
Fricatives	2.32	**0.02***	3.65	**0.00***	-	-	-	-	-	-	-	-
Flap	2.73	**0.00***	1.01	0.31	4.07	**0.00***	-	-	4.14	**0.00***	-	-
Nasals	2.78	**0.00***	3.84	**0.00***	0.61	0.53	-	-	-	-	-	-
Continuants	3.13	**0.00***	1.19	0.23	3.91	**0.00***	0.52	0.59	3.78	**0.00***	-	-
Laterals	2.11	**0.02***	3.15	**0.00***	1.03	0.29	3.85	**0.00***	0.54	0.49	3.67	**0.00***

Note. * = significance at 0.01 and 0.05 level.

Figure 4.8 illustrates the mean percentages for manner of articulation for within and across languages in both groups. The rank order of disfluent consonants according to manner of articulation for ML, from most frequent to least frequent, are as follows: flap, continuants, affricates, stops, laterals, fricatives, and nasals. It can be concluded that flap was the most disfluent category of consonants while the nasals were the least disfluent.

c. Comparison of consonant categories within BL CWS

Table 4.30 and Figure 4.8 represent the descriptive scores of disfluent consonant categories with respect to manner of articulation within BL CWS. Considering, the analysis using one way repeated measures ANOVA revealed a significant difference across the categories considering manner of articulation in Kannada language [F (4, 80) = 16.33; p <0.05]. Further, pair-wise comparisons of the same suggested significant difference across stops in comparison to continuants and flap; across affricates in comparison to flap and nasals; across flap in comparison to nasals; across nasals in comparison to continuants. However, for the category of fricatives, Wilcoxon signed rank test indicated that fricatives and laterals differed significantly from stops (|z| = 3.56; p <0.05), affricates (|z| = 3.40; p <0.05), flap (|z| = 4.01; p <0.05), and continuants (|z| = 4.13; p <0.05), with the exception of nasals in Kannada language for the BL group. The rank order of disfluent consonants according to manner of articulation in Kannada in BL, from most frequent to least frequent are as follows: flap, continuants, affricates, stops, laterals, nasals and fricatives. It can be concluded that flap was the most disfluent category of consonants while the fricatives were the least disfluent. Comparing the data of the ML and BL groups in Kannada language, it can be inferred that the most disfluent categories of consonants with regard to manner of articulation remained the same across both groups, with the exception of fricatives and nasals.

One way repeated measures ANOVA revealed a significant difference across the categories considering manner of articulation in English language [F (6, 120) = 7.64; p <0.05]. Further, pair-wise comparisons of the same suggested significant difference across affricates in comparison to stops and nasals; and stops in comparison to flap. The data suggests that affricates were significantly higher as compared to all the other categories mentioned above. Furthermore, flap was significantly higher compared to stops. Wilcoxon signed rank test was administered for the category of continuants and the results of which revealed no significant difference in comparison to other categories. Table 4.33 depicts the results of Wilcoxon signed rank test of continuants in comparison to other categories.

Table 4.33

Results of Wilcoxon signed rank test while comparing continuants and other categories in ML CWS

Comparisons	|z|	p
Continuants - Stops	0.28	0.77
Continuants - Affricates	1.41	0.15
Continuants - Fricatives	1.30	0.19
Continuants - Flap	1.36	0.17
Continuants - Lateral	0.59	0.55
Continuants - Nasals	0.81	0.41

The frequency of occurrence of disfluent consonants according to manner of articulation in English among BL CWS, from most frequent to least frequent, are as follows: affricates, flap, fricatives, lateral, nasals, continuants and stops. It can be concluded that affricates were the most disfluent category of consonants while the stops were the least disfluent.

The paired t-test was adopted to analyze categories of manner of articulation, across languages in BL CWS. The results suggested significant difference across the categories of affricates, fricatives, flap, laterals and nasals. However, no such difference existed for the category of stops and continuants ($|z| = 0.67$; $p > 0.05$) across both languages. Table 4.34 presents the results of paired t-test with respect to manner of articulation across languages in BL CWS. Further analysis revealed that the categories of affricates, fricatives, laterals, and nasals had significantly higher frequency of disfluencies in English, with the exception of the category of flap.

Table 4.34
Results of paired t-test across languages in BL CWS

Phoneme categories based on manner of articulation	t	df	p
Stops	0.46	24	0.64
Affricates	2.25	22	**0.03***
Fricatives	3.09	24	**0.00***
Flap	2.03	24	**0.05***
Laterals	4.56	12	**0.00***
Nasals	2.97	24	**0.00***

Note. *= significant at 0.05 level.

To summarize, the results suggest that the frequency of occurrence of disfluent consonants, considering manner of articulation, revealed that flap, continuants, affricates, stops, and laterals showed identical pattern between ML and BL groups in Kannada language, with the exception of nasals and fricatives. It was inferred that flap was the most disfluent category of consonants while the fricatives and nasals were the least disfluent in BLK and MLK respectively. The frequency of occurrence of disfluent consonants according to manner of articulation in English among BL CWS, from most to least frequently disfluent were, affricates, flap, fricatives, laterals, nasals, continuants and stops. It can be concluded that affricates were the most disfluent category of consonants while the stops were the least disfluent. Further, the analysis between languages revealed that the categories of affricates, fricatives, flap, laterals and nasals varied significantly.

4.4.1.1.6. Disfluent vowels

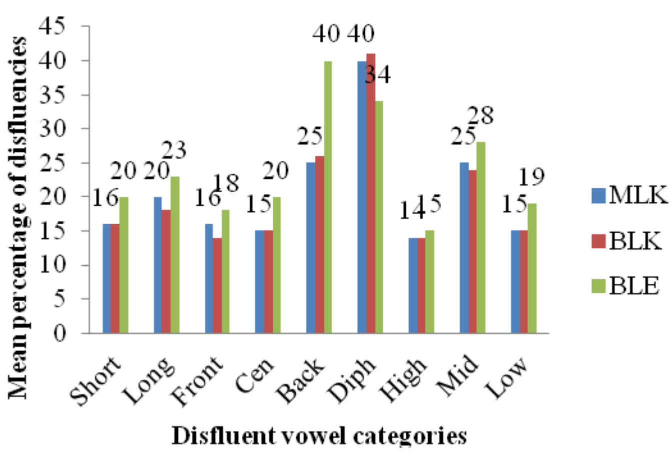
The vowels were classified as short and long, according to position of the tongue (front, central, back) and height of the tongue (high, mid, low). The mean percentage of disfluent vowel categories was calculated by considering the ratio of the total number of times the vowel categories were disfluent to the total number of vowel categories that occurred in the speech sample, multiplied by 100. Figure 4.9 shows the mean percentage of disfluencies for vowel categories in groups of CWS. Table 4.35 displays the descriptive statistics of percent disfluent vowel categories considered under study.

Table 4.35

Mean, SD and Median of percent disfluent vowel categories

Disfluent vowel		MLK				BLK				BLE		
categories	N	Mean	SD	Median	N	Mean	SD	Median	N	Mean	SD	Median
Short	35	15.60	08.16	14.00	25	16.28	08.51	14.00	25	20.04	11.41	19.00
Long	35	20.08	10.46	16.00	25	17.68	10.46	15.00	13	23.15	15.78	25.00
Front	35	16.00	07.25	16.00	25	14.00	08.05	12.00	25	18.32	12.16	16.00
Central	35	14.77	10.85	11.00	25	15.12	09.59	16.00	20	19.75	13.96	18.50
Back	35	25.28	11.62	23.00	25	26.12	13.52	23.00	19	39.68	33.95	31.00
Diphthongs	13	40.30	26.97	27.00	17	41.23	29.00	29.00	22	33.63	27.11	26.50
High	35	14.42	08.08	15.00	25	13.92	08.01	14.00	22	14.68	11.80	11.00
Mid	35	24.65	09.59	25.00	25	24.48	12.10	27.00	23	27.69	15.87	28.00
Low	35	14.77	10.85	11.00	25	15.12	09.59	16.00	23	19.26	12.57	16.00
Total Vowels	35	16.82	07.83	16.00	25	16.52	08.39	16.00	25	19.64	10.59	18.00

Note. MLK= monolingual Kannada, BLK= bilingual Kannada, BLE= bilingual English.



Note. Cen = central, Diph = diphthongs, MLK= monolingual Kannada, BLK= bilingual Kannada, BLE= bilingual English.

Figure 4.9. Mean percentage of disfluencies for vowel categories in groups of CWS.

Table 4.36 displays the results of the non-parametric Mann-Whitney U test and Wilcoxon signed rank test for disfluent vowel categories in CWS groups. The comparison of vowel categories with respect to position of the tongue (front, central, back) was analyzed using the Friedman test. The results suggested significant difference across the categories in ML [$\chi^2(2) = 29.60$, $p < 0.05$] and BL CWS [$\chi^2(2) = 26.73$, $p < 0.05$]. Similarly, the Friedman test performed for categories based on height of the tongue (high, mid, low) revealed a significant difference for both the ML [$\chi^2(2) = 35.75$, $p < 0.05$] and BL Kannada [$\chi^2(2) = 30.12$, $p < 0.05$] groups.

Table 4.36
Results of Mann- Whitney test ($) and Wilcoxon signed rank test (#) for disfluent vowel categories across groups of CWS

Vowel categories	MLK & BLK ($)		BLK & BLE (#)	
	$\lvert z \rvert$	p	$\lvert z \rvert$	p
Short	0.33	0.73	1.58	0.11
Long	0.89	0.37	0.49	0.62
Front	1.36	0.17	1.58	0.11
Central	0.16	0.86	1.24	0.21
Back	0.14	0.88	0.86	0.38
Diphthongs	0.21	0.83	1.47	0.14
High	0.12	0.89	0.32	0.74
Mid	0.54	0.58	0.88	0.37
Low	0.16	0.86	0.79	0.42
Total vowels	0.17	0.86	1.33	0.18

Note. MLK= monolingual Kannada, BLK= bilingual Kannada, BLE= bilingual English.

The Wilcoxon signed rank test, employed for the pair-wise comparisons of vowel categories within the ML group, suggested a significant difference for long and short vowels; back vowels in comparison to central and front vowels; mid vowels in comparison to high and low vowels and total vowels in comparison to diphthongs. Table 4.37 illustrates the results of Wilcoxon signed rank test within the ML and BL groups of CWS. Further analysis of the results revealed that the long vowels had a higher frequency of disfluencies than short vowels. Considering the tongue position, back vowels presented with an increased frequency of disfluencies with respect to central and front vowels. With respect to tongue height, mid vowels demonstrated a greater frequency of disfluencies compared to high and low vowels. In addition, total diphthongs were significantly higher compared to total vowels. Identical to the ML CWS, the BL Kannada group also revealed similar findings except the category of long and short vowels.

Table 4.37
Results of Wilcoxon signed rank test for disfluent vowel categories in groups of CWS

	MLK		BLK		BLE	
Disfluent vowel categories	z	p	z	p	z	p
Long-short	3.19	**0.00***	0.97	0.33	0.66	0.50
Central-front	1.72	0.08	0.31	0.75	^	
Back-front	4.38	**0.00***	4.20	**0.00***	^	
Back-central	4.21	**0.00***	4.09	**0.00***	^	
Mid-high	4.62	**0.00***	4.37	**0.00***	3.57	**0.00***
Low-high	0.53	0.59	1.10	0.26	1.17	0.24
Low-mid	4.19	**0.00***	3.98	**0.00***	1.84	0.06
Diphthongs - total vowels	2.23	**0.02***	3.29	**0.00***	2.51	**0.01***

Note. MLK= monolingual Kannada, BLK= bilingual Kannada, BLE= bilingual English, * = significance at 0.05 level, ^ = Friedman test results revealed no significant difference among these categories.

The results of the Friedman test for the BL English group revealed no significant difference [χ^2 (2) = 1.05, p > 0.05] across the categories based on tongue position. However, a significant difference was found across categories based on tongue height [χ^2 (2) = 12.49, p < 0.05]. The Wilcoxon signed rank test, employed for the pair-wise comparisons of vowel categories within the BL English group, suggested a significant difference for mid vowels in comparison to high vowels and total vowels in comparison to diphthongs. Table 4.37 illustrates the results of Wilcoxon signed rank test for the BL English group. Further analysis of the results revealed that the mid vowels had a higher frequency of disfluencies than high vowels.

The pair-wise comparisons of vowel categories within the BL group across languages, English and Kannada was performed using Wilcoxon signed rank test. Table 4.36 summarizes the results for the BL CWS across languages. The results suggested no significant differences across any of the comparisons, suggesting a similar trend between languages.

To summarize the results regarding disfluent vowels the frequency of occurrence of disfluent short and long vowels, vowels based on position and height of the tongue did not vary significantly in ML and BL group indicating a similar trend in both the groups. The results indicated significant difference between back vowels compared to front and central vowels; mid vowels compared to high and low vowels; diphthongs compared to total vowels in both the groups in Kannada language. It was found that back vowels exhibited increased occurrence of disfluencies compared to front and central vowels. In addition, the mid vowels exhibited increased occurrence of disfluencies compared to high and low vowels. It was also found that the total diphthongs were significantly higher compared to total vowels in both the languages in BL CWS. Comparing across languages revealed that none of the vowel categories varied significantly in the BL group suggesting a similar trend.

4.4.1.2. Disfluencies based on phoneme position

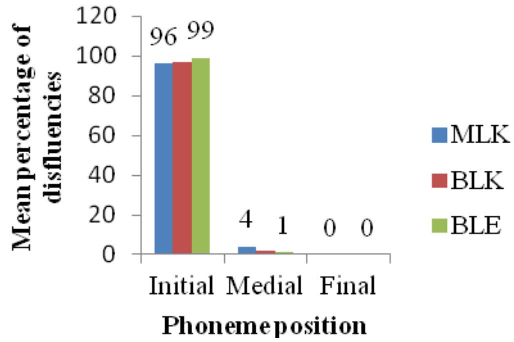
The position of the instances of disfluencies are classified as initial, medial and final position based on the occurrence of disfluencies at phoneme or syllable level in each word present in both the groups of CWS. The mean percentage of disfluencies based on phoneme position was calculated by considering the ratio of the total instances of disfluencies in each position to the total occurrence of disfluencies in all positions in the speech sample, multiplied by 100. Table 4.38 displays the descriptive statistics of percent disfluencies based on phoneme position in both ML and BL group of CWS. Figure 4.10 shows the comparison of mean percentage scores for phoneme position across groups. It can be noted that the mean percentage of disfluencies in initial position ranged from 96-99% and 1% to 3.6% in medial position for all groups.

Table 4.38

Mean, SD and Median of percent disfluencies in different phoneme positions

Phoneme	MLK			BLK			BLE		
position	Mean	SD	Median	Mean	SD	Median	Mean	SD	Median
Initial	96.48	1.42	100.00	97.44	1.04	100.00	98.96	0.20	100.00
Medial	3.60	1.81	3.00	2.33	0.51	2.00	1.00	-	1.00
Final	-	-	-	-	-	-	-	-	-

Note. MLK= monolingual Kannada, BLK= bilingual Kannada, BLE= bilingual English.



Note. MLK= monolingual Kannada, BLK= bilingual Kannada, BLE= bilingual English.

Figure 4.10. Mean percentage scores of disfluencies in all phoneme positions.

The phoneme position was compared across the ML and BL group in Kannada language using Mann Whitney U test. The results revealed no significant difference for initial and medial positions across both the groups. Table 4.39 summarizes the test results of Mann Whitney U test for phoneme position for groups. It is evident from the above table and figure that the frequency of occurrence of disfluencies at phoneme or syllable level in each word was significantly present in initial position compared to other positions in both the ML and BL groups. The results of Wilcoxon signed rank test suggested significant difference for ML ($|z| = 2.03$, $p < 0.05$) and BL Kannada ($|z| = 2.99$, $p < 0.05$) across initial and medial positions. The frequency of occurrence of disfluencies at final position within a word was not present in either of the groups.

Table 4.39
Results of Mann Whitney U test for phoneme position across groups

Word position	MLK and BLK	
	|z|	p
Initial	0.81	0.41
Medial	1.20	0.22

Note. MLK= monolingual Kannada, BLK= bilingual Kannada.

The analyses of phoneme position within the BL group across languages, English and Kannada was performed using Wilcoxon signed rank test. The pair-wise comparisons of categories of word position were performed only for initial position since the occurrences of other positions were limited. The results suggested significant difference for initial position across languages ($|z| = 2.23$, $p < 0.05$). It was found that the frequency of occurrence of disfluencies was significantly higher in English compared to Kannada.

Summarizing the results related to phoneme position revealed no significant difference for any of the positions across the ML and BL group in Kannada language. The findings indicated a similar pattern for both the groups. It suggests that the rank order of the frequency of disfluencies with regard to phoneme position included; initial and medial in MLK, BLK & BLE group of CWS. Majority of the children exhibited disfluencies in initial position compared to medial position. In addition, there was no occurrence of disfluencies in final position in both the groups.

4.4.2. Morphological determinants of disfluencies

The linguistic characteristics of words were analyzed with regard to word class and word length and its influence on the instances of stuttering. The results are mentioned in the following sections.

4.4.2.1. Disfluencies based on word class

Broadly, the word classes are classified as content and function words based on the importance and the role of word in each language. The content words were further classified as nouns, verbs, adjectives and adverbs; the function words were further classified as pronouns, auxiliary verbs, conjunctions, prepositions and articles.

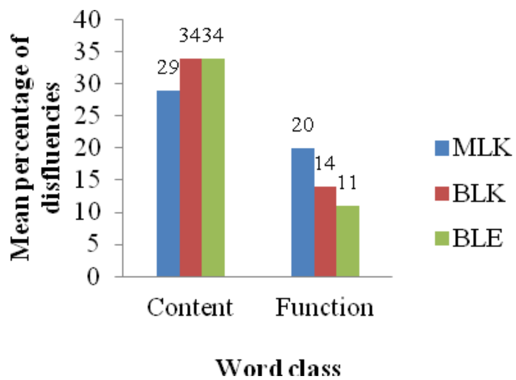
4.4.2.1.1. Content and function words

The comparisons of occurrence of disfluencies on content and function words were performed across the ML and BL group. Mann-Whitney U test was administered to compare the major word class categories (content and function). According to the analysis there was no significant difference between the ML and BL CWS for both the word class categories, suggesting a similar pattern in both the groups. The mean frequency of content words were found to be significantly greater compared to function words. Table 4.40 and figure 4.11 displays the descriptive scores of total content and function words in ML and BL CWS.

Table 4.40
Descriptive scores of total content and function words in ML and BL CWS

Word Class	MLK		BLK		BLE	
	M	SD	M	SD	M	SD
Content	29.22	14.76	33.52	11.11	34.44	10.52
Function	19.85	09.71	14.37	19.00	10.92	08.00

Note. MLK= monolingual Kannada, BLK= bilingual Kannada, BLE= bilingual English.



Note. MLK= monolingual Kannada, BLK= bilingual Kannada, BLE= bilingual English.

Figure 4.11. Mean percentage of disfluencies of word class for groups of CWS.

With respect to the BL group, Wilcoxon signed rank test was used to compare the frequency of content and function words in both the languages. The results showed significant difference for the content and function words in both Kannada ($|z| = 3.48$; $p < 0.05$) and English ($|z| = 4.37$; $p < 0.05$) languages. Interpretation of the above data appeared to favor the occurrence of content words compared to function words in both the languages of BL group. Furthermore, a significant difference was noted for function words ($|z| = 3.16$; $p < 0.05$); but not so for content words ($|z| = 0.52$; $p > 0.05$) across languages. This can be attributed to the occurrence of content words with similar pattern in both the languages. However, function words tended to occur significantly higher in Kannada compared to English.

To summarize the results regarding disfluencies based on word class suggested a similar pattern in both ML and BL groups in Kannada language. The mean frequency of content words were found to be significantly greater compared to function words. Similar results were obtained in BL group in English language. Thus, the overall results suggested almost similar pattern with regard to the occurrence of disfluencies in categories of content and function words in the groups considered under study. In-depth analysis of word class categories across languages suggested similar pattern for content words, but the findings varied for function words.

4.4.2.1.2. Comparisons within content word categories

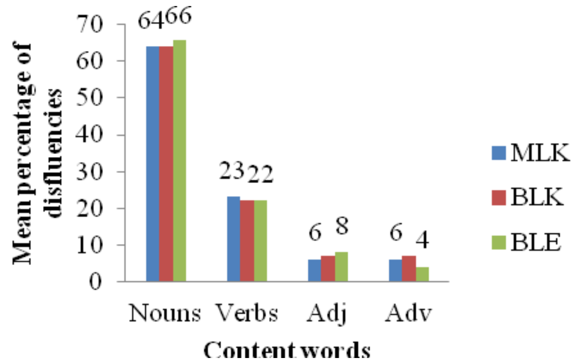
The mean percentage of disfluencies based on content word class was calculated by considering the ratio of the total instances of disfluencies on specific content word class to the total instances of disfluent content words in the speech sample, multiplied by 100. The mean percentages of nouns, verbs, adjectives and adverbs accounted to 64%, 23%, 6% and 6% in ML group respectively. Similarly, in the same order of content word class it accounted to 64%, 22%, 7% and 7% in BL in Kannada language and 66%, 22%, 8% and 4% in BL in English language respectively.

Table 4.41
Mean SD and Median of percent disfluencies for content word categories

Content Words	ML Kannada (N = 35)			BL Kannada (N = 25)			BL English (N = 25*)		
	M	SD	Median	M	SD	Median	M	SD	Median
Nouns	64.05	7.40	65.00	64.36	9.33	66.00	66.16	9.80	67.00
Verbs	22.91	6.31	23.00	21.96	6.05	20.00	21.84	7.98	22.00
Adjectives	6.08	2.93	5.00	6.96	4.00	6.00	8.36	4.75	8.00
Adverbs	6.05	3.26	6.00	6.96	4.14	6.00	4.42	2.84	5.00
Total	85.57	6.36	86.00	86.64	6.51	87.00	83.04	10.78	86.00

Note. *N = 22 for the category of Adverbs in bilingual English group.

Table 4.41 displays the descriptive statistics of percent disfluencies based on categories of content word class in both ML and BL groups. Figure 4.12 shows the comparison of mean percentage scores for content word categories for groups.



Note. Adj= adjectives, Adv= adverbs, MLK= monolingual Kannada, BLK= bilingual Kannada, BLE= bilingual English.

Figure 4.12. Mean percentage of disfluencies for content word categories in CWS groups.

The comparisons of within the content word categories were performed for across and within the ML and BL groups of CWS. The non- parametric test, Mann Whitney U test was used to compare the four categories of content words across groups. The results revealed no significant difference for the categories of content words, such as nouns, verbs, adjectives and adverbs while comparing across ML and BL groups in Kannada language. Table 4.42 displays the test results of Mann Whitney U test and Wilcoxon signed rank test across groups.

Table 4.42
Results of Mann-Whitney U test ($) and Wilcoxon signed rank test (#) with respect to content word categories for both groups and across languages in BL CWS

Content words	MLK & BLK ($)		BLK & BLE (#)	
	|z|	p	|z|	p
Nouns	0.42	0.66	0.86	0.38
Verbs	0.90	0.36	0.04	0.96
Adjectives	0.58	0.56	1.37	0.17
Adverbs	0.64	0.51	2.96	**0.00***

Note. MLK= monolingual Kannada, BLK= bilingual Kannada, BLE= bilingual English,
*= significant at 0.01 level.

In both ML and BL groups of CWS the categories of content words were analyzed using the Friedman test. The results suggested significant difference across the categories of content words in the group of ML [$\chi^2(3) = 93.79$, $p < 0.05$], BL Kannada

[$\chi^2(3) = 64.30$, $p < 0.00$] and BL English [$\chi^2(3) = 61.62$, $p < 0.00$] CWS. Table 4.43 illustrates the results of Wilcoxon signed rank test within ML and BL CWS. The Wilcoxon signed rank test, employed for the pair-wise comparisons of content word categories suggested a significant difference for nouns and verbs in comparison with adjectives and adverbs; nouns in comparison with verbs in all 3 groups. The rank order of the frequency of disfluencies with regard to content words included; nouns, verbs, adjectives and adverbs in ML and BL group of CWS.

Table 4.43
Results of Wilcoxon signed rank test for the categories of content words in groups of CWS

Comparisons	MLK		BLK		BLE	
	z	p	z	p	z	p
Verb-Noun	5.16	**0.00***	4.37	**0.00***	4.37	**0.00***
Adjectives-Noun	5.16	**0.00***	4.37	**0.00***	4.37	**0.00***
Adverb- Noun	5.16	**0.00***	4.37	**0.00***	4.10	**0.00***
Adjective-Verb	5.16	**0.00***	4.34	**0.00***	4.19	**0.00***
Adverb-Verb	5.09	**0.00***	4.35	**0.00***	4.10	**0.00***
Adverb-Adjectives	0.31	0.75	0.35	0.72	3.16	**0.00***

Note. MLK= monolingual Kannada, BLK= bilingual Kannada, BLE= bilingual English,
*= significant at 0.01 level.

The pair-wise comparisons of categories of content words within the BL group across languages, English and Kannada was performed using Wilcoxon signed rank test. Table 4.42 summarizes the results of Wilcoxon signed rank test for the BL CWS across languages. The results suggested no significant differences across majority of the comparisons, with the exception of adverbs. Findings indicated a similar trend between languages for the category of nouns, verbs and adjectives. However, the category of adverbs was significantly more disfluent in Kannada compared to English.

4.4.2.1.3. Comparisons within function words categories

The comparisons of within function words categories were performed that included pronouns, auxiliary verbs, conjunctions, prepositions and articles/particles. The mean percentage of disfluencies based on function word class was calculated by considering the ratio of the total instances of disfluencies on specific function word class to the total number of disfluent function words in the speech sample, multiplied by 100.

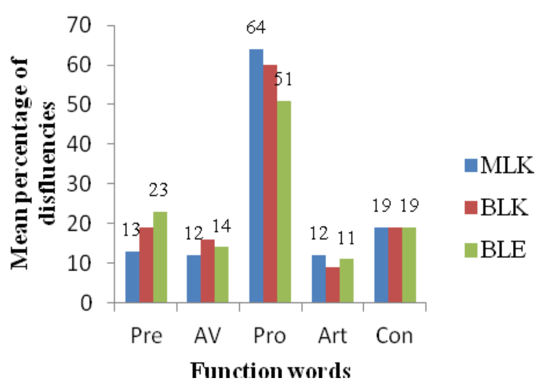
The mean percentages of prepositions, auxiliary verbs, pronouns, articles and conjunctions accounted to 13%, 12%, 63%, 11% and 19% in ML group respectively. Similarly, in the same order of function word class it accounted to 19%, 16%, 60%, 9% and 19% in BL in Kannada language and 23%, 14%, 51%, 11% and 19% in BL in English language respectively. Table 4.44 displays the descriptive statistics of percent disfluencies based on categories of function word class in both ML and BL group. Figure 4.13 shows the comparison of mean percentage scores for function word categories in both the groups.

Table 4.44

Mean, SD and Median of percent disfluencies for function words categories

	MLK			BLK			BLE		
Disfluent Function words	N	M (SD)	Median	N	M (SD)	Median	N	M (SD)	Median
Prepositions	29	13.37 (9.20)	11.00	22	18. 59 (12. 07)	14.00	22	22.95 (13.67)	18.00
Auxiliary verbs	10	12.00 (10.58)	08.50	3	16.33 (12. 66)	21.00	16	14.12 (13.83)	07.00
Pronouns	34	63.76 (16.42)	62.00	25	60.28 (21. 43)	62.00	24	51.20 (17.14)	51.00
Articles	21	11.71 (7.17)	12.00	16	08.75 (6.10)	06.50	14	10.50 (9.12)	07.00
Conjunctions	31	18.67 (17.42)	15.00	23	19.13 (15.62)	14.00	21	18.90 (12.57)	17.00
Total	35	14.42 (6.36)	14.00	25	13.12 (6.32)	13.00	25	15.52 (6.93)	14.00

Note. MLK= monolingual Kannada, BLK= bilingual Kannada, BLE= bilingual English.



Note. Pre = prepositions, AV = auxillary verbs, Pro = pronouns, Art = articles, Con = conjunctions, ML= monolingual Kannada, BLK= bilingual Kannada, BLE= bilingual English.

Figure 4.13. Mean percentage of disfluencies for function word categories in groups of CWS.

The non-parametric Mann Whitney U test was used to compare the five categories of function words across ML and BL groups in Kannada language. The results revealed no significant difference for the categories of function words, such as pronouns, auxiliary verbs, conjunctions, prepositions and articles across groups. Table 4.45 displays the results of Mann- Whitney U test across groups. These findings indicated that both the ML and BL groups exhibited a similar pattern with regard to function word categories.

Table 4.45

Results of Mann-Whitney U test ($) and Wilcoxon signed rank test (#) with respect to function word categories for both groups and across languages in BL CWS

Function words	MLK & BLK ($)		BLK & BLE (#)	
	|z|	p	|z|	p
Pronouns	0.56	0.57	1.37	0.17
Auxiliary verbs	0.33	0.73	0.44	0.65
Conjunctions	0.08	0.93	0.20	0.84
Prepositions	1.67	0.09	1.38	0.16
Articles	1.26	0.20	0.25	0.79

Note. MLK= monolingual Kannada, BLK= bilingual Kannada, BLE= bilingual English.

In ML group of CWS, the categories of function words were analyzed using the Friedman test. The results suggested significant difference [$\chi^2(4) = 12.28$, $p < 0.05$] across the categories within the group of ML CWS. The Wilcoxon signed rank test, employed for the pair-wise comparisons of function word categories within the ML group, suggested a significant difference for pronouns in comparison with prepositions, conjunctions and articles; articles in comparison with auxiliary verbs and conjunctions. Table 4.46 summarizes the results of Wilcoxon signed rank test for the categories of function words in ML and BL groups. The rank order of the frequency of disfluencies with regard to function words included; pronouns, conjunctions, prepositions, auxiliary verbs and articles in ML group of CWS.

Considering the BL group of CWS in Kannada language the categories of function words were analyzed using the Wilcoxon signed rank test. The results suggested significant difference for pronouns in comparison with prepositions, articles and conjunctions; articles in comparison with prepositions in BL group of CWS in Kannada language. The rank order of the frequency of disfluencies was similar to that of the ML group.

Table 4.46
Results of Wilcoxon signed rank test for the categories of function words in groups of CWS

Comparisons	MLK		BLK		BLE	
	|z|	p	|z|	p	|z|	p
Aux verbs-Prepositions	0.67	0.49	1.34	0.18	1.78	0.07
Pronouns-Prepositions	4.63	**0.00***	3.70	**0.00***	3.84	**0.00***
Articles- Prepositions	0.67	0.50	2.27	**0.02***	2.62	**0.00***
Conjunctions-Prepositions	0.43	0.66	0.10	0.91	1.32	0.18
Pronouns-Aux verbs	2.80	**0.00***	1.60	0.10	3.35	**0.00***
Articles-Aux verbs	2.37	**0.01***	0.44	0.65	0.67	0.50
Conjunctions-Aux verbs	0.94	0.34	1.06	0.28	1.49	0.13
Articles Pronouns	4.01	**0.00***	3.51	**0.00***	3.11	**0.00***
Conjunctions-Pronouns	4.78	**0.00***	3.76	**0.00***	3.40	**0.00***
Conjunctions-Articles	2.15	**0.03***	1.64	0.10	1.78	0.07

Note. Aux verbs = auxiliary verbs, MLK = monolingual Kannada, BLK = bilingual Kannada, BLE = bilingual English, *= significant at 0.05 level.

Considering the BL group of CWS in English language the categories of function words were analyzed using the Friedman test. The results suggested significant difference [$\chi^2(4) = 22.45$, $p < 0.00$] across the categories within the group of BL CWS. The Wilcoxon signed rank test, employed for the pair-wise comparisons of function word categories within the BL group in English language, suggested a significant difference for pronouns in comparison with conjunctions, prepositions, auxiliary verbs and articles; prepositions in comparison with articles. The findings suggested that the pronouns varied significantly from most of the other categories. Table 4.46 summarizes the results of Wilcoxon signed rank test for the categories of function words in BL group for English language. The rank order of the frequency of disfluencies with regard to function words included; pronouns, prepositions, conjunctions, auxiliary verbs and articles in BL group in English language.

The pair-wise comparisons of categories of function words within the BL group across languages, English and Kannada was performed using Wilcoxon signed rank test. Table 4.45 summarizes the results of Wilcoxon signed rank test for the categories of function words in BL group across languages. The results suggested no significant differences across all the comparisons within the category of function words suggesting a similar trend between languages.

To summarize the results regarding disfluencies based on word class suggested a similar pattern in both ML and BL groups in Kannada language. The mean frequency of content words were found to be significantly greater compared to function words. Similar results were obtained in BL group in English language. In ML and BL group of CWS, the rank order of the frequency of disfluencies within the content word categories included; nouns, verbs, adjectives and adverbs. Similar results were noted across languages with the exception of adverbs which were highly disfluent in Kannada compared to English. Summarizing the results for the categories of function words both the groups exhibited a similar pattern. The rank order with regard to frequency of disfluencies of function words included: pronouns, conjunctions, prepositions, auxiliary verbs and articles in both ML and BL group of CWS in Kannada language. In addition, a similar trend was found in BL group for English language with the exception of the order of prepositions and conjunctions only. Thus, the overall results suggested almost similar pattern with regard to the occurrence of disfluencies in categories of content and function words in the groups considered under study.

4.4.2.2. Disfluencies based on word length

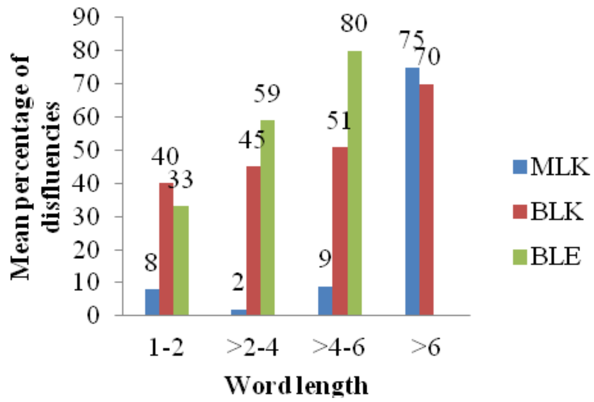
The word length was measured by counting the number of syllables in the fluent and disfluent word samples of each participant. It was classified as 1-2 syllables, >2-4 syllables, >4-6 syllables and >6 syllable categories. The mean percentage of disfluencies based on word length was calculated by considering the ratio of the total instances of disfluencies in each word length to the total occurrence of specific word length in the speech sample, multiplied by 100. Table 4.47 displays the descriptive statistics of percent disfluencies based on categories of word length in both ML and BL group. Figure 4.14 shows the comparison of mean percentage scores for word length categories across groups.

Table 4.47

Mean SD and Median of percent disfluencies based on word length

Word length (Syllables/ Word)	MLK				BLK				BLE			
	N	M	SD	Med	N	M	SD	Med	N	M	SD	Med
1 – 2	35	07.85	13.53	33.00	25	40.24	09.75	40.00	25	33.44	07.51	34.00
>2-4	35	02.42	12.12	39.00	25	45.04	10.47	45.00	25	59.36	11.39	59.00
>4-6	35	09.02	10.67	45.00	24	50.91	13.47	50.50	13	80.23	11.51	81.00
>6	11	74.54	16.48	80.00	09	70.11	10.10	71.00	-	-	-	-

Note. MLK = monolingual Kannada, BLK = bilingual Kannada, BLE = bilingual English, Med = median.



Note. MLK= monolingual Kannada, BLK= bilingual Kannada, BLE= bilingual English.

Figure 4.14. Mean percentage of disfluencies for word length in groups of CWS.

4.4.2.2.1. Word length across ML and BL groups

The comparisons of word length across the ML and BL groups in Kannada language were performed using the Mann-Whitney U test. According to the analysis there was no significant difference across all the 4 word length categories, suggesting a similar trend in both the groups. The mean percentage of disfluencies for word length indicated the rank order as >6 syllables, >4 to 6 syllables, >2 to 4 syllables and 1 to 2 syllables in both the groups. Table 4.48 displays the results of Mann-Whitney U test for word length across groups.

Table 4.48
Results of Mann-Whitney U test with respect to word length across both groups

Word length	|z|	p
1-2	1.61	0.10
>2-4	1.20	0.22
>4-6	0.62	0.53
>6	1.22	0.22

4.4.2.2.2. Word length in ML group

In ML group of CWS the categories of word length were analyzed using the Friedman test. The results suggested significant difference [$\chi^2(2) = 51.20$, $p < 0.00$] across the categories within the group of ML CWS. The Wilcoxon signed rank test, employed for the pair-wise comparisons of word length within the ML group suggested a significant difference across all categories of word length.

Table 4.49
Results of Wilcoxon signed rank test for the categories of word length in ML CWS

Word length comparisons	|z|	p
1 to 2 and >2 to 4 syllables	4.09	**0.00***
1 to 2 and >4 to 6 syllables	4.55	**0.00***
>2 to 4 and >4 to 6 syllables	5.09	**0.00***
1 to 2 and >6 syllables	2.49	**0.01***
>2 to 4 and >6 syllables	2.58	**0.01***
>4 to 6 and >6 syllables	2.49	**0.01***

Note. *= significant at 0.05 level.

Table 4.49 summarizes the results of Wilcoxon signed rank test for the categories of word length in ML group. The analysis suggested that the mean percentage of disfluencies for word length indicates a rank order of >6 syllables, >4 to 6 syllables, >2 to 4 syllables and 1 to 2 syllables. The findings indicated an increased percentage of disfluencies for increased number of syllables in a word.

4.4.2.2.3. Word length in BL group

The comparisons of categories of word length were performed in the BL group. One way repeated measures ANOVA was administered to study the main and interaction effects of the categories (1 to 2, >2 to 4, and >4 to 6 syllables only). According to the analysis there was significant main effect of categories [F (2, 46) = 24.31; p <0.00] in the BL CWS in Kannada language. The pair-wise comparisons revealed a significant difference across all the 3 categories of word length. The category of >6 syllables was compared using the paired t-test (with alpha correction) as the number of distribution was lesser (11 out of 35). The analysis suggested a significant difference for word length with >6 syllables in comparison with 1 to 2 syllables [t (8) = 5.92; p <0.00], >2 to 4 syllables [t (8) = 5.11; p <0.00] and >4 to 6 syllables [t (8) = 3.44; p <0.00]. The mean frequency of disfluencies for word length with >6 syllables was found to be significantly higher compared to other 3 word lengths in BL CWS for Kannada language.

With respect to the comparisons in BL group for English language, the paired t-test (with alpha correction) was employed and the results revealed a significant difference for word length with 1 to 2 syllables compared to >2 to 4 syllables [t (24) = 12.07; p <0.00] and >4 to 6 syllables [t (12) = 16.60; p <0.00]; and >2 to 4 syllables in comparison with >4 to 6 syllables [t (12) = 4.36; p <0.00]. It was found that the children produced the words with the maximum of 6 syllables word length in English language. The mean frequency of disfluencies for word length with >4 to 6 syllables was found to be significantly greater followed by >2 to 4 syllables and 1 to 2 syllables in BL CWS for English language.

Similarly, the comparisons in BL group across Kannada and English languages were performed using the paired t-test (with alpha correction). The results revealed a significant difference for word length for all the 3 categories, 1 to 2 syllables [t (24) = 3.82; p <0.00]; >2 to 4 syllables [t (24) = 5.24; p <0.00] and >4 to 6 syllables [t (11) = 8.78; p <0.00] across languages. It was found that the mean frequency of disfluencies was greater for word length with >2 to 4 syllables and >4 to 6 syllables in English compared to Kannada language, with the exception of 1 to 2 syllables. Though the percentage of disfluencies varied significantly across languages, similar trend of increase in disfluencies with more number of syllables were noted in both the languages.

To summarize the results regarding the frequency of occurrence of disfluencies based on word length suggested no significant difference in ML and BL group indicating a similar trend in both the groups. Analysis indicated the rank order as >6 syllables, >4 to 6 syllables, >2 to 4 syllables and 1 to 2 syllables in both the groups. It was found that the children produced the words with the maximum of 6 syllables word length in English language. The mean frequency of disfluencies for word length with >4 to 6 syllables was found to be significantly greater followed by >2 to 4 syllables and 1 to 2 syllables in BL CWS in English language. The mean frequency of disfluencies was greater for word length with >2 to 4 syllables and >4 to 6 syllables in English compared to Kannada language, with the exception of 1 to 2 syllables. Though the percentage of disfluencies varied significantly across languages similar trend was observed. The findings indicated an increased percentage of disfluencies with increased number of syllables in a word.

4.4.3. Syntactic determinants of disfluencies

The syntactic determinants included the frequency of occurrence of disfluencies based on sentence structure at phrase level and sentence length, the measure of words per sentence varied from greater than two words to >9 words. The results are mentioned in the following sections.

4.4.3.1. Disfluencies based on sentence structure

Broadly, sentence structure can be classified as noun phrase and verb phrase based on the presence of specific word classes in these sentences. A noun phrase comprises of a noun (person, place, or thing) and the modifiers which distinguish it. Modifiers can occur either prior or after the noun, and includes articles, possessive nouns, adjectives, participles, prepositional phrases, adjective clauses, participle phrases, and infinitives. The verb phrase is a syntactic unit composed of atleast one verb and its dependents such as objects, complements, and other modifiers (Greenbaum, 2005).

The comparisons of noun phrase and verb phrase was performed across the ML and BL group. The mean frequency of verb phrases were found to be significantly greater compared to noun phrases in all 3 groups of CWS under study. Table 4.50 and figure 4.15 displays the descriptive scores of noun and verb phrases in ML and BL CWS.

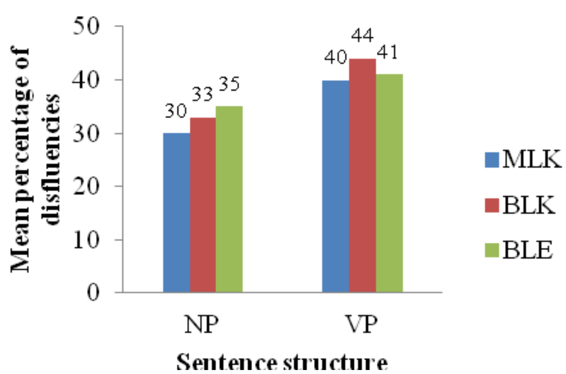
Table 4.50

Mean and SD of disfluent noun and verb phrases in ML and BL CWS

Sentence Structure	MLK		BLK		BLE	
	M	SD	M	SD	M	SD
Noun Phrase	30.34	9.00	33.16	13.60	35.28	11.90
Verb Phrase	40.11	9.56	43.84	9.14	41.36	13.21

Note. MLK = monolingual Kannada, BLK= bilingual Kannada, BLE= bilingual English.

Mixed ANOVA was administered to study the main and interaction effects of the groups (ML and BL) and categories (noun and verb phrase). Table 4.51 displays the results of mixed ANOVA across groups and categories. According to the analysis there was significant main effect of categories, but there was no significant main effect of groups and interaction between groups and categories.



Note. NP = Noun phrase, VP = Verb phrase, MLK = monolingual Kannada, BLK = bilingual Kannada, BLE= bilingual English.

Figure 4.15. Mean percentage of disfluencies of sentence structure for groups of CWS.

Table 4.51

Results of mixed ANOVA for the effect of the groups and categories (NP & VP)

Particulars	F (1, 58)	Sig.	p value
ML and BL groups	1.82	0.18	>0.05
Categories	74.83	0.00	**<0.05****
Groups*categories	0.14	0.70	>0.05

Note. MLK = monolingual Kannada, BL = bilingual, * = interaction of groups and categories, ** = significant at 0.05 level, NP = noun phrase, VP = verb phrase.

The analyses using paired t-test for comparison of categories (noun phrase and verb phrase) within MLK and BLK group suggested significant difference between noun and verb phrases. The results confirmed the occurrence of disfluencies in verb phrases to be greater compared to noun phrases in both the ML and BL CWS. In addition, the results of paired t-test across languages in BL CWS suggested no significant difference for noun and verb phrases, suggesting a similar pattern. Table 4.52 displays the results of paired t-test in ML and BL CWS and across languages.

Table 4.52

Results of paired t-test for noun and verb phrases in CWS groups

Comparisons	Parameters	MLK	BLK	BLE	BLK & BLE (VP)	BLK & BLE (NP)
Verb and	t	4.05	4.46	1.99	1.03	0.91
Noun Phrase	df	34	24	24	24	24
	p	**0.00***	**0.00***	**0.05***	0.31	0.37

Note. MLK = monolingual Kannada, BLK = bilingual Kannada, BLE = bilingual English, VP = verb phrase, NP = noun phrase, * = significant at 0.05 level.

To summarize the results regarding disfluencies based on sentence structure based on noun and verb phrase suggested a similar pattern in both ML and BL groups in Kannada and English languages. The mean frequency of verb phrase were found to be significantly greater compared to noun phrase. Thus, the overall results suggested almost similar pattern with regard to the occurrence of disfluencies in categories of noun and verb phrase in the groups considered under study.

4.4.3.2. Disfluencies based on sentence length

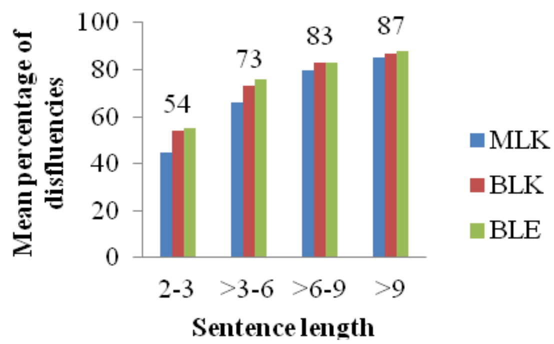
The sentence length was measured by counting the number of words in the fluent and disfluent sentences of each participant. It was classified as 2-3 words, >3-6 words, >6-9 words and >9 words categories. The mean percentage of disfluencies based on sentence length was calculated by considering the ratio of the total instances of disfluencies in each sentence length to the total occurrence of specific sentence length in the speech sample, multiplied by 100. Table 4.53 displays the descriptive statistics of percent disfluencies based on categories of sentence length in both ML and BL groups. Figure 4.16 shows the comparison of mean percentage scores for sentence length categories in both the groups.

Table 4.53

Mean, SD and Median of percent disfluencies for sentence length

	MLK				BLK				BLE		
Words / Sentence	N	M	SD	Median	N	M	SD	Median	M	SD	Median
2-3	35	44.60	14.57	42.00	25	53.92	15.84	57.00	54.92	19.11	53.00
>3-6	35	66.05	12.64	64.00	25	73.20	14.52	77.00	75.92	14.33	73.00
>6-9	35	79.80	08.53	80.00	25	82.56	14.12	86.00	82.84	12.77	89.00
>9	28	85.17	06.50	85.00	25	86.84	11.43	91.00	87.68	09.71	92.00

Note. MLK = monolingual Kannada, BLK = bilingual Kannada, BLE = bilingual English.



Note. MLK = monolingual Kannada, BLK= bilingual Kannada, BLE= bilingual English.

Figure 4.16. Mean percentage of disfluencies for sentence length in groups of CWS.

4.4.3.2.1. Sentence length across ML and BL groups

The comparisons of sentence length across the ML and BL groups in Kannada language were performed using the Mann Whitney U test. According to the analysis there was significant difference across the sentence length with 2 to 3 words, >3 to 6 words and >9 words with the exception of >6 to 9 words across both the groups. Table 4.54 displays the test results of Mann Whitney U test for sentence length across groups. The mean percentage of disfluencies for sentence length indicated significantly greater frequency of occurrence in BL compared to ML CWS, while a similar trend was observed for only >6 to 9 words.

Table 4.54
Results of Mann-Whitney U test ($) and Wilcoxon signed rank test (#) with respect to sentence length for both groups and across languages in BL CWS

Words per sentence	MLK & BLK ($)		BLK & BLE (#)	
	|z|	p	|z|	p
2 - 3	2.38	**0.01***	0.43	0.66
>3 - 6	2.18	**0.02***	0.91	0.36
>6 - 9	1.83	0.06	0.42	0.67
>9	1.97	**0.04***	0.25	0.79

Note. MLK= monolingual Kannada, BLK= bilingual Kannada, BLE= bilingual English,
*= significant at 0.05 level.

4.4.3.2.2. Sentence length in ML group

One way repeated measures ANOVA was employed to study the main and interaction effects of categories (>3-6, >6-9 and >9 words in a sentence) in ML group. According to the analysis there was significant main effect of categories [F (2, 54) = 117.05; p <0.00]. The pair-wise comparisons among the ML group revealed a significant difference across 3 comparisons. The Wilcoxon signed rank test was employed for the pair-wise comparisons of 2-3 words with other categories of sentence length. The analyses indicated a significant difference for 2-3 words in comparison with >3-6 words (|z|= 5.16, p < 0.00), >6-9 words (|z|= 5.16, p < 0.00) and >9 words (|z|= 4.62, p < 0.00). The analysis suggested that the mean percentage of disfluencies for sentence length indicated a rank order of >9 words, >6-9 words, >3-6 words and 2-3 words in a sentence.

The findings indicated an increased percentage of disfluencies with increased number of words in a sentence.

4.4.3.2.3. Sentence length in BL group

The comparisons of categories of sentence length such as, 2-3 words, >3-6 words, >6-9 words and >9 words were performed within the BL group. The Friedman test was employed to determine the effects and the results suggested significant difference [χ^2 (3) = 66.07, p < 0.00] across the categories within the group of BL CWS in Kannada language. The Wilcoxon signed rank test, employed for the pair-wise comparisons of sentence length categories within the BL group, suggested a significant difference. Table 4.54 summarizes the results of Wilcoxon signed rank test for the categories of sentence length in BL group in Kannada and English languages. It suggests that the rank order of the frequency of disfluencies with regard to sentence length included; >9 words, >6-9 words, >3-6 words and 2-3 words in a sentence. The findings indicated an increased percentage of disfluencies with increased number of words in a sentence.

Similarly, the comparisons of categories of sentence length were performed within the BL group in English language. The Friedman test was employed to determine the effects and the results suggested significant difference [χ^2 (3) = 60.03, p < 0.00] across the categories within the group of BL CWS in English language. The Wilcoxon signed rank test, employed for the pair-wise comparisons of sentence length categories within the BL group, suggested a significant difference.

Table 4.55
Results of Wilcoxon signed rank test for the categories of sentence length in BL group for Kannada and English languages

	BLK		BLE	
Sentence length	z	p	z	p
2 to 3 and >3 to 6 words	4.37	**0.00***	4.34	**0.00***
2 to 3 and >6 to 9 words	4.37	**0.00***	4.28	**0.00***
2 to 3 and >9 words	4.37	**0.00***	4.37	**0.00***
>3 to 6 and >6 to 9 words	4.31	**0.00***	3.18	**0.01***
>3 to 6 and >9 words	4.34	**0.00***	3.88	**0.00***
>6 to 9 and >9 words	2.77	0.06	3.27	**0.01***

Note. BLK = bilingual Kannada, BLE = bilingual English,*= significant at 0.05 level.

Table 4.55 displays the results of Wilcoxon signed rank test for the categories of sentence length in BL group in English language. It suggests that the rank order of the frequency of disfluencies with regard to sentence length included; >9 words, >6-9 words, >3-6 words and 2-3 words in a sentence. The findings indicated an increased percentage of disfluencies with increased number of words in a sentence. The comparisons in BL group across Kannada and English languages were performed using the non-parametric test Wilcoxon signed rank test. The results revealed no significant difference for 2 to 3 words ($|z| = 0.43$; $p > 0.05$), >3 to 6 words ($|z| = 0.91$; $p > 0.05$), >6-9 words ($|z| = 0.42$; $p > 0.05$) and >9 words ($|z| = 0.25$; $p > 0.05$) across languages. The findings revealed a similar trend with regard to sentence length in both the languages. Table 4.53 illustrates the results of Wilcoxon signed rank test for sentence length in BL group across languages.

To summarize the results regarding the frequency of occurrence of disfluencies based on sentence length suggested no significant difference in ML and BL group indicating a similar trend in both the groups. Analysis indicated the rank order as >9 words, >6-9 words, >3-6 words, and 2-3 words in a sentence in both the groups. In addition, similar results were noted in BL group across the Kannada and English languages. The findings indicated an increased percentage of disfluencies for increased number of words in a sentence.

DISCUSSION

The results of the present study are discussed under the four major sections. These include: (1) the types of disfluencies and severity of stuttering across ML and BL CWS and languages; (2) the language abilities based on the standardized tests for the first and the second language between CWS and CWNS and also between ML and BL groups; (3) the relationship between severity of stuttering and language abilities and (4) the influence of linguistic determinants in terms of phonetic, morphological and syntactic aspects.

5.1. Types of disfluencies and severity of stuttering

Overall, as a group similar trend was noted for the occurrence of SLDs, ODs, and total SSI score in both monolingual and bilingual group of CWS. The analysis suggests that both groups exhibited similar pattern with regard to types of disfluencies. The degree of stuttering across both monolingual and bilingual groups revealed that majority of CWS exhibited moderate severity in both languages. In addition, as a group the patterns of disfluencies seem to be similar in both the languages spoken by the bilingual CWS. However, the analysis of individual bilingual CWS across languages presented a differential pattern while comparing with the degree of severity. The present study is in agreement with Jayaram (1977) who analyzed the speech of adult bilingual speakers of Kannada and English. He found comparable amounts of stuttering in both languages of the speakers suggesting no differences in the pattern or distribution of stuttering. These findings support Nwokah's (1988) assumption of the second possibility of occurrence among bilinguals – "Same Hypothesis". This hypothesis postulates that when a bilingual person stutters, he or she stutters similarly in each of the languages. Another case in strong agreement with the postulations of the same hypothesis was portrayed by Lebrun, Bijleveld, and Rousseau (1990). However, in their study the client began to stutter following brain damage. It was noted that stuttering occurred as a consequence of acquired neurological disease and the severity was equally affected in both French and Dutch.

In the present study, based on the SSI score, majority of the bilingual CWS (80%) exhibited similar pattern of disfluencies which supported the "Same hypothesis". However, remaining 20% of CWS showed different pattern of disfluenices though not significant. It was noted that only 4% (1 CWS) of bilingual CWS had greater severity in Kannada compared to English. Moreover, around 16% (4 CWS) had greater severity in English compared to Kannada. These results support the Difference Hypothesis proposed by Nwokah (1988) that stuttering occurs differently in both languages. A plausible explanation for this hypothesis maybe the fact that the second language requires more planning and anticipation, and hence is produced more fluently motorically as compared to the first language. According to this hypothesis the occurrence of stuttering depends on where, when, and to whom the languages are usually spoken by the PWS, personal attitudes and experiences with the languages (Krause, 1982). The results of the present study indicated difference pattern of stuttering in the two languages used by bilinguals with regard to severity and percentage of SLDs and ODs in about 20% of CWS. Shenker et al.'s (1998) study indicated that an English – French bilingual pre-school child had greater SLDs in English as compared to French. They noted higher number of word repetitions in French and increased part-word repetitions observed in English. This was reported to be a reflection of the child's uneven language acquisition in English and French. These findings are also partially consistent with that of Howell et al. (1999); Leah and Geetha (2008); and Sneha et al. (2008), although there were individual variations with regard to different speaking conditions in their studies.

The present study is in partial agreement with findings of Taliancich-Klinger et al. (2013) who noted more stuttering in English compared to the child's primary language. They found more disfluent speech behaviours in English for narrative and conversational output than Spanish in a 6 year old CWS and SLDs were evident in Spanish and an opposite pattern was evident in English (more of other disfluencies).

There are several reasons for disparity in stuttering across languages which include the actual linguistic structure of the languages considered, language competence, task demands (for instance, narrative in opposition to procedural discourse), rate and prosodic distinctions between languages. English and Kannada are essentially different in their linguistic structure. There is slight or no commonality whatsoever in their respective written forms, grammar (syntax), morphology, phonology and syllable constitution. Kannada is one of the major Dravidian syllabic languages spoken in India and is a mora timed language where each consonant cluster is followed by vowel and no word ends with consonants (Savithri & Jayaram, 2006). English on the other hand is phonemic and stress timed language with more complex syllable options available (Abercrombie, 1976).

The bilingual speakers who stutter (BWS) mostly exhibit stuttering in both the languages which may or may not be identical across languages. The linguistic or motor models of stuttering offer contributions to account for the different patterns across languages in bilinguals. In a subgroup of PWS, linguistic differences could attribute to the presence of stuttering. According to the model, there may be “varied ways of organizing motor output in a language that the speaker is more fluent in (the speaker’s first language) that hamper language output and ways of organizing output in a language that the speaker is less fluent in (the speaker’s second language) that assist or augment language output” (Klein et al., 1994).

In conclusion, it can be said that the relationship between stuttering and bilingualism is complex. From the various studies done, it can be seen that there is disparity in the findings reported in the studies of bilingual PWS. There are differences with respect to severity and patterns of disfluencies in one or more languages spoken by the individuals. Researchers strongly recommend that fluency assessments be completed in both languages of bilingual CWS in order to prepare an all-inclusive treatment program. India being a multilingual nation with a majority of the population speaking more than one language and a good number of school going children exposed to at least three languages by the middle school and beyond, it becomes imperative, especially in this context to study about stuttering in association with bilingualism.

5.2. Language abilities

The language measures were analyzed and compared between CWS and CWNS using Linguistic profile test in both monolingual and bilingual groups. Further, the language measures were also compared between monolingual and bilingual CWS and normal children. In addition, the language measures were analyzed using ELTIC and compared between bilingual CWS and CWNS and are discussed as follows.

5.2.1. Language abilities based on the performance of LPT

In general CWS performed poorer than CWNS in most of the language measures. For better understanding, the discussion of the results are grouped under performance of CWS as poorer, equal and better with respect to CWNS.

5.2.1.1. CWS poorer than CWNS

ML CWS scored significantly poorer than CWNS on total syntax and total language sections of the LPT. The findings of subsections of LPT revealed significant difference for antonymy and polar questions under the section of semantics, and for all the subsections of syntax with the exception of morphophonemic structures across ML CWS and CWNS. Further analysis indicated that ML CWS had poorer scores in these subsections compared to CWNS. While comparing BL CWS and CWNS, the findings of the subsections of LPT revealed significant difference for the subsections of antonymy, homonymy, polar questions and semantic anomaly under the section of semantics, and conjunctions, comparatives, quotatives, and conditional clauses under the section of syntax. Further analysis indicated that BL CWS had poorer scores in all these subsections compared to CWNS, with the exception of homonymy.

The present study is in agreement with few studies which address weaker lexical knowledge in PWS. Reduced vocabulary and/or subtle lexical difficulties (for instance, the capacity to resolve lexical ambiguity) have been noted in both adults and children who stutter, on standardized and experimental tasks (Arnold et al., 2005; Byrd & Cooper, 1989; Murray & Reed, 1977; Watson et al., 1994; Westby, 1974). Evidences for the diminished levels of lexical diversity noted in spontaneous conversational samples in CWS have been offered by Silverman and Bernstein Ratner (2002). In addition, Anderson et al. (2005) also noted atypical gaps between the receptive and expressive lexical abilities of young CWS, and construed the size of such “gaps” to parallel with stuttering behaviours. Such findings highlight the possibility that complexities in lexical access might be a factor influencing fluency.

In the present study, for syntax task few sections had reduced score in a group of CWS compared to CWNS. These findings are in agreement with those of Yashaswini and

Geetha (2011) who reported of significantly poorer performance in CWS on syntax and all meta-phonological tasks with the exception of rhyme recognition and phoneme oddity. In consensus with these results, Ntourou et al. (2011) have shown that CWS scored significantly lower on measures of overall language ability, receptive and expressive vocabularies, and MLU compared to CWNS. The authors have suggested that CWS, as a group, demonstrate "subtle differences in language abilities when compared to their normally fluent peers" and that "language may be an influential variable associated with the difficulty that some CWS have establishing normally fluent speech". The results of Arndt and Healey (2001) indicated that a total of 30% CWS also had a concomitant language disorder. Their findings confer support the DC model, arguing that "some preschool children might be vulnerable to developing poor expressive language if the stuttering persists into the elementary school-age years" and that "problems or difficulties in expressive language abilities might be a by-product of stuttering for several years".

Also supporting the findings is Silverman and Bernstein Ratner’s (2002) study, wherein CWS differed from CWNS in their performance on the Expressive One-Word Picture Vocabulary Test but not in their performance on the Peabody Picture Vocabulary Test-Revised (PPVT–R). Though these results hint at a deficit in expressive language development in CWS, they also suggest that CWS attempt to avoid saying certain words that might elicit stuttering and tend to substitute these for others easier to say (Bloodstein, 1995). Therefore, it is probable that at least for some CWS, a poor score on such a test may not be a true indication of their expressive language abilities, but rather a reflection of their attempts to avoid stuttering on dreaded sounds/words. In agreement with these current findings, several researchers have contended that CWS, as a group, are more liable to have fragile or disordered language skills than CWNS (Anderson et al., 2006; Arndt & Healey, 2001; Blood et al., 2003; Bloodstein, 2006; Hakim & Bernstein Ratner, 2004; Ntourou et al., 2011; Tetnowski et al., 2012; Yaruss et al., 1998).

5.2.1.2. CWS equal to CWNS

The present findings on language measures suggested that the CWS performed on par with CWNS on some of the sections of Linguistic profile test. Considering the group of monolinguals the summary of findings revealed no significant difference for the majority of the subsections of phonology and semantics. Similarly, the group of bilinguals demonstrated comparable results, with majority of the subsections of phonology, semantics, and syntax not varying significantly between CWNS and CWS.

The findings of the present study are in agreement with Kadi-Hanifi and Howell (1992) who indicated no differences in syntactic development of CWS and CWNS. However, the authors suggested caution while generalizing the results due to small numbers of children in each subgroup. Howell et al. (2003) also examined syntactic development (passive voice, relative clauses, and complex reasoning based on grammatical structures) which revealed no statistical significance between groups. Similarly, Bajaj (2007) indicated no statistically significant differences on the variables, such as story length, morphological development, syntactic complexity, or the use of story grammar components. Bernstein Ratner et al. (2009) concluded comparable patterns of responses with respect to word frequency and neighborhood characteristics and no significant differences in naming accuracy were noted overall between the two groups. They suggested that disparities in language production between PWS and normals are less likely to occur as a consequence of atypical phonological organization of lexical neighborhoods. Yashaswini and Geetha (2011) who examined linguistic and metalinguistic abilities in CWS between the ages of 8 and 12 years also found no statistically significant difference in performances of CWS and CWNS on the semantic section of the LPT.

In a more recent study, Sasisekaran and Byrd (2013) failed to uncover any differences between both groups of children with and without stuttering and suggested that the “processing and/or representation of holistic and segmental units in speech production are intact in CWS”. Another interpretation by the same authors accounting for this lack of difference between CWS and CWNS on the verbal monitoring tasks may be because the monitoring skills of CWS are in overdrive (Bernstein Ratner, 1997), possibly compensating for a primary phonological processing obscurity or latency. The results of the present study are also in agreement with those of Sasisekaran and Byrd (2013).

5.2.1.3. CWS better than CWNS

In the present study the analyses of language measures also suggested that bilingual CWS outperformed their fluent peers on homonymy under the domain of semantics. In support of the these findings, Watkins (2005) study suggests that the presence of superior expressive language skills may be a probable factor inducing stuttering in some children, by placing undue demands for fluent and adult-like language production on an immature speech motor system.

These findings suggest that CWS are every bit as likely as CWNS to demonstrate the full range of language abilities - poor, average, and superior; as evidenced by their performance on norm-referenced tests. Along similar lines, Yaruss et al. (1999) reported that CWS as a group tended to behave heterogeneously with 25% classified as above normal limits (ANL), 46% as within normal limits (WNL), and 29% as below normal limits (BNL) in expressive language development. A number of studies have compared groups of CWS and CWNS on language development, frequently using norm-referenced language tests and occasionally using language sampling tasks. Nippold (2010) suggested utilizing narrative or expository tasks, which additionally challenge a speaker's linguistic system, thereby aiding in the identification of syntactic deficits in young children. Moreover, narrative tasks have the capacity to reveal subtle language deficits in children, otherwise neglected with norm-referenced language tests (Roth & Spekman, 1986; Westby, 1984). Thus, it is necessary to explore the language and stuttering dimension in greater detail by incorporating comprehensive assessment procedures.

In general, as a whole, the mixed results obtained across studies regarding the language abilities in CWS compared to CWNS may probably be due to methodological limitations in various studies. These include failure to match the groups on key factors such as gender and SES; excluding CWNS from participating in the study if they exhibited signs of a language deficit and not the CWS and use of timed speaking tasks to compare the language skills of CWS to those of CWNS, inevitably putting CWS at a definite disadvantage due to their difficulty initiating and advancing in speech.

5.2.2. Comparison of language abilities in ML (between CWS and CWNS) and BL (between CWS and CWNS) based on results of LPT

As in the previous section the discussion of the results are grouped under performance of monolinguals as poorer, equal and better with respect to bilingual CWS and CWNS.

5.2.2.1. Monolinguals poorer than bilinguals

The data analyses of language measures related to monolingual and bilingual CWS and CWNS suggested that the monolinguals performed poorer than bilinguals on some of the sections of Linguistic profile test. The findings indicated significantly higher scores in bilingual CWS for the subsections of semantics such as synonymy, syntagmatic relations, semantic contiguity, semantic similarity, and participle constructions under the section of syntax.

In agreement with the findings, the researchers on bilingualism indicate the influence of one language on another and also improved cognitive functions outside of language. It has also been shown that bilinguals benefit over monolinguals with regard to cognitive advantages contributing towards linguistic development, perception, attention and inhibitory control (Cook, 1997). Klein et al. (1994) commented that "the knowledge of two languages is greater than the sum of its parts." These authors argue that bilinguals exhibit certain linguistic benefits compared to monolinguals. In case the structures and rules of two languages are distinctly different, the child will be required to think in more sophisticated ways. This facilitates a bilingual child’s understanding of the structure of language, achieve a superior awareness of meanings, an increase in metalinguistic awareness and recognize words in continuous speech (Adesope et al., 2010; Bialystok, 1988). Research has demonstrated that bilingual children excel in tasks necessitating inhibitory control (e.g., disregard misleading perceptual cues). Along the same lines, Martin-rhee and Bialystok (2008) reported that the bilingual advantage was predominant in tasks of interference suppression (e.g., controlling attention to competing cues) but not in tasks of response inhibition (e.g., control over competing responses). Recent research by Kapa and Colombo (2013) also lend support to the notion of bilingual advantage, wherein bilinguals outperformed monolinguals on a range of cognitive tests, signifying advantages in cognitive control.

5.2.2.2. Monolinguals equal to bilinguals

The present findings also suggested no significant difference for majority of the subsections of semantics across ML and BL CWNS, and subsections of syntax across ML and BL CWS. Overall language abilities (as determined by LPT total language score) did not vary across ML and BL in both CWS and CWNS.

In consensus with the current study, Core et al. (2011) report that while monolingual children demonstrate larger vocabulary scores, the vocabulary scores of bilingual children does increase with age, identical as that of their monolingual peers. The authors also report of no absolute differences in total vocabulary size or total vocabulary gains amongst both groups of children, suggesting that both sets of children have similar vocabulary sizes and gain the same vocabulary knowledge.

5.2.2.3. Monolinguals better than bilinguals

The summary of analyses of language measures related to monolingual and bilingual CWS and CWNS suggested that the monolinguals performed better compared to bilinguals on some of the sections of Linguistic profile test. The findings indicated significantly higher scores in monolingual CWS and CWNS for the subsections of phonemic discrimination, total phonology, lexical category, and homonymy. Additionally, ML CWNS outperformed their BL peers on the subsections of syntax, such as plural forms, PNG markers, case markers, transitives, intransitives, and causatives, predicates, conjunctions and quotatives.

The present study is in agreement with Magiste (1980) who attributes such response to be due to a differential familiarity with the native language. Ransdell and Fischler (1987) found slower response rates for abstract words in bilinguals compared to their monolinguals peers. Supporting the present study, Bialystok et al. (2008) indicated that monolinguals often had a more expansive vocabulary in their native language compared to bilinguals. This further increases the efficiency by which words are retrieved in monolinguals as the access to words is faster in the target language. In addition, Gollan et al. (2008) commented on “weaker links” hypothesis which proposed that bilinguals are at a distinct disadvantage relative to their monolingual peers on verbal tasks as they are required to effectively divide the frequency-of-use between both languages. This partially holds good even in the present study as a linguistic disadvantage was noticed in some of the sections of the LPT among bilinguals.

The current findings are also in agreement with the study by Bialystok et al. (2010). It lends support to the speculation that bilinguals possess a smaller vocabulary in a language than monolinguals. The authors suggest that this difference is confined to words pertinent to a home context rather than a school context. In general, this effect on linguistic performance in a bilingual child is seen as a deficit in which such children exercise control over a more restricted vocabulary than their monolingual peers.

Several studies have compared the language abilities between monolingual and bilingual normal children but not with a group of CWS. It is important to note that mixed results are found regarding the language performance across groups. Though, the recent studies (Adesope et al., 2010; Bialystok, 1988) have suggested that the multilinguals or bilinguals have an ability to understand better in terms of overall language, they may also be confined to disadvantage with regard to word usage in first language.

Overall, the present study demonstrated similar pattern on total language score in CWS (ML and BL) and CWNS (ML and BL). In-depth analyses relate to small differences in the subsections of language scores sometimes favoring monolingual group, sometimes bilingual group and sometimes both exhibiting a similar pattern.

5.2.3. Language abilities of bilingual CWS and CWNS based on results of ELTIC

The analyses of ELTIC results indicated that the scores were almost similar in BL CWS compared to CWNS which suggested an identical performance across the groups. It suggested that semantic, morphological, syntactic and total language scores in English language was almost similar across CWS and CWNS.

In agreement with the current study Howell et al. (2003) found that "CWS (within 5 to 10 years of age) could produce sentences that contained later developing features such as the passive voice, relative clauses, and complex reasoning". Their results revealed no statistical significance between the groups. Likewise, Bajaj (2007) reported no statistical significance across variables, such as story length, morphological development, syntactic complexity, or the use of story grammar components between CWS and their fluent peers.

Identical language abilities expressed in the second language across CWS and CWNS support some of the issues with regard to usage based theory of language development (Tomasello, 2003). These theories focus on the input that child receives from immediate environment and the amount of usage of second language by the child. Other factors that contribute to language abilities relates to educational settings, active participation, and exposure to language through television. The present findings suggested that the children of both the groups could have received similar exposure and used in the same manner as the results confined to identical performance by both CWS and CWNS. In India, majority of children attend English medium school and hence English becomes the primary language of instruction. Children are encouraged to communicate in schools and thus contributing to successful communication. In particular, it was noted that parents of bilingual children were educated, aware of English language and belonged to mid socioeconomic status. In agreement to these, Bohman et al. (2010) found that the parent education affects bilingual children's development of English, as second language.

In conclusion, the results of language abilities with regard to second language demonstrated similar results in majority of CWS and CWNS. Comparisons of the findings could not be directly correlated with earlier studies due to lack of research related to standardized language measures in the second language of CWS.

5.3. Stuttering severity and language abilities in children with stuttering

In the present study, the language abilities in Kannada language measured on LPT indicated that ML CWS with moderate degree of stuttering performed better on total syntax and total language than children with a severe degree of stuttering. In agreement with the present study, Hall et al. (1993) reported of a relationship between an imbalance in aspects of language such as, heightened lexical abilities and reduced morpho-syntactic skills; and an increase in disfluencies. Their findings were explained based on the neuropsycholinguistic model proposed by Perkins et al. (1991) which postulated that these imbalances in speech and language processes lead to impediments in fluency. These findings were also explained based on the Demands and Capacities model (Starkweather & Gottwald, 1990) which hypothesized impediments in fluency to arise from discrepancies in demands and capacities in PWS, specifically greater lexical abilities that exceeded morphosyntactic abilities in the participants considered in Hall et al.'s (1993) study. Although Hall (1996) concluded that CWS as a group demonstrated greater fluency with improved language abilities, individual variability did tend to exist. She delineated her results into 2 patterns, where the first pattern revealed impairments in morphosyntactic (expressive) skills associated with increased instances of stuttering-like disfluencies, while the second pattern demonstrated limited receptive abilities and enhanced expressive skills with increased instances of other disfluencies.

Silverman and Ratner (2002) found a significant negative correlation between SSI and Type Token Ratio, associating increased severity of stuttering to reduced lexical diversity. Millager et al. (2014) suggested a significant positive correlation between the results of Expressive Vocabulary Test and frequency of stuttering. These findings appear to suggest that "CWS show subtle disturbances in their developing speech-language systems, with more frequent stuttering associated with greater vulnerabilities related to the planning and production of expressive language". Consistent with this assumption, Ntourou et al. (2011) suggested that, "when planning/formulating sentences, CWS may experience subtle but important difficulties in quickly and efficiently encoding and retrieving lexical items"

In the present study, for the group of BL CWS significant differences were not found between severity of stuttering in Kannada language and language abilities. In addition, the analyses of second language abilities in English as measured on ELTIC also indicated no significant differences across severity. In consensus with the present study, Hall (1996) concluded that as a group CWS demonstrated greater fluency with improved language abilities, although individual variability tended to exist. Salihovic et al. (2010) also indicated no significant correlation across degrees of stuttering and language abilities with respect to vocabulary in CWS. Additionally, Anderson and Conture (2000) also found no significant correlation on the comparison of receptive/expressive language and receptive vocabulary scores with the overall stuttering frequency of CWS.

5.4. Linguistic determinants of disfluencies

The influences of linguistic variables in CWS were investigated in the present study. Linguistic aspects of stuttering included the analysis of the loci and frequency of stuttered events related to the phonetic, morphological and syntactic components of language in both monolingual and bilingual CWS and across languages, Kannada and English are discussed below.

5.4.1. Phonetic determinants

The phonetic influences included the occurrence of disfluent phonemes with regard to total consonants, total vowels, voiced and unvoiced consonants, clusters, and disfluent phonemes based on place and manner of articulation.

5.4.1.1. Consonants and Vowels

The occurrence of disfluent consonants was significantly higher compared to disfluent vowels in monolingual and bilingual CWS. A similar trend was observed in both the groups. Also, within the bilingual group, disfluent consonants had a significantly higher occurrence in both the languages compared to vowels indicating the presence of similar pattern across languages. The results of the current study are in consensus with the earlier studies (Brown, 1945; Hejna, 1963; Geetha, 1979; Johnson & Brown, 1935). Hahn (1942) noted an obvious difference in frequency of occurrence across consonants and vowels and found that only 2.9% of the total stuttering occurred on words starting with a vowel. However, in our study the occurrence of disfluent consonants ranged from 32% to 34% and disfluent vowels ranged from 16% to 19%. Furthermore, Howell et al. (2000) noted the difficulty in CWS on words that began with late emerging consonants. In our study the analysis with respect to early and late emergent consonants based on disfluencies was not performed.

The findings of various studies confirm the existence of phonetic attributes, with regard to the increased occurrence of disfluent consonants compared to disfluent vowels. The probable reason for such a difference could be due to the physiological and phonetic variations between the consonants and vowels. The literature suggests that the consonants involve complex production compared to vowels. "Consonants are sounds produced with a significant constriction in the oral and/or pharyngeal cavities during their production. In contrast, vowels are produced with a relatively open vocal tract and no significant constriction exists in the cavities. The production of consonants involves the contribution of almost all articulators, while vowels are produced with an approximation without any obstruction in the air passage" (Ladefoged, 2001).

Consonants contribute more to the clarity, distinctness of speech and tend to be more complex to articulate. These may be the possible reasons as to why an increased frequency of stuttering was noted on consonants as compared against vowels. In contrast to the present findings, Wingate (2002) pointed out that "these differences between consonants and vowels are misleading as it is an artifact undoubtedly occasioned by the structure of words. In fact, analysis of word structure clearly refutes the belief that consonants are more difficult than vowels. First, and particularly important, most words begin with consonants. Significantly, initial position is where stuttering occurs most and hence the position of stuttering instances emerges as critical".

5.4.1.2. Consonants and Clusters

The results comparing the occurrence of disfluent clusters and consonants revealed no significant difference between monolingual and bilingual groups indicating a similar trend in both the groups. It was found that the clusters were significantly more disfluent than consonants in both the groups in Kannada compared to English language, and more so in the initial position. However, there was no significant difference between the languages for consonants indicating the presence of similar trend across languages. In support to the present study, Howell et al. (2000) ascertained that clusters demonstrated an increased chance of stuttering in word-initial position.

The probable reason for increased disfluencies on clusters could be due to the production of clusters that involves more than one segment compared to singleton consonants. It involves a group or sequence of consonants that appear together in a syllable without a vowel between them. It requires refinement in articulation of individual speech segments with greater or quicker transitory movement of articulators (Robb & Blomgren, 1996). It was noted that CWS exhibited either slower motor execution or longer central processing or both before execution (Postma & Kolk, 1993). Stromsta (1986) concluded that deficient anticipatory coarticulation is probably the primary element in the core behaviour of stuttering. In addition, Chang et al. (2002) noted an acoustic evidence for abnormal coarticulation in preschool CWS. Surprisingly, Cooper and Allen (1977) report of lack of coordination between voicing, respiration and articulation for not just non-fluent utterances but for the fluent utterances of PWS as well. These authors further report, that PWS are hindered in their ability to repeat the temporal pattern of an utterance, as if their neural clocks are less accurate or more susceptible to errors of timing. Due to this physiological reason, CWS may have exhibited a significant increase in disfluencies on clusters compared to consonants in monolingual and bilingual groups in Kannada language.

The findings of the current study support the viewpoint of Index of Phonetic Complexity (IPC). According to IPC proposed by Jakielski (1998) heterorganic clusters (eg., /fk/, /pt/) are more complicated phonetically as compared to homorganic clusters (eg., /st/, /ps/). This is because it involves the coordination of various articulators. Also, various intrinsic biomechanical and physiological properties of the articulators play a major role in transition. The production of clusters relate to accomplishing very different and more actions concurrently which becomes a more complex task. The IPC concept thus supports the complexity of clusters which could be the probable reason for the increased occurrence of stuttering. However, in the present study the analyses did not involve the classification of clusters as heterorganic and/or homorganic.

Huinck et al. (2004) found that, particularly for PWS, "producing two consonants that shared the same place of articulation across a syllable boundary was a complex task as it placed higher demands on motor planning and/or initiation than producing the same cluster within a syllable". The results of Huinck et al. (2004) suggest that the place of articulation of consonants in a cluster relates to instances of stuttering suggesting similar place of articulation leading to less disfluencies within the syllable. In the present study an attempt was made to analyze the frequency of disfluencies on clusters compared to singleton consonants. Further research seems warranted with regard to type of cluster and its relation to place of articulation with the disfluent utterance to comment on the results of Huinck et al's study.

Sasisekaran and Byrd (2013) reported that CWS may demonstrate difficulties with segmental monitoring as the phonemic complexity of the utterance increases, which was evident for consonant clusters compared to singleton consonants. A delay in segmentation skills during speech production has been hypothesized to adversely affect performance on phonological encoding, resulting in the typical errors of fluency observed during speech production. Researchers have also emphasized the relative influence of phonetic difficulty which may be more conspicuous when compared to other linguistic factors. Howell et al. (2000) found that the content words that contained later emerging consonants and/or consonant strings in the initial position of words demonstrated more likelihood of being stuttered. Given that not much research has dwelled on the relationship between stuttering and cluster complexity, further empirical evidences are required to confirm statements in this regard.

5.4.1.3. Voiced and Unvoiced Consonants

5.4.1.3.1. Equal disfluencies on Unvoiced and voiced consonants

In the present study, majority of the groups (ML and BLE) exhibited no significant difference between disfluent voiced and unvoiced consonants. This suggested the existence of a similar pattern among majority of children under study. Contrary to the results of our study, Wall et al. (1981) reported that stuttering occurred significantly on words which were voiced after a brief pause. In continuous speech, the voicing feature of the sounds adjacent to the stuttered phoneme also influenced the likelihood of stuttering. Their results report increased instances of stuttering for voiced consonants, but in the present study significant differences were not observed between voiced and unvoiced consonants in majority of CWS.

5.4.1.3.2. Disfluencies on unvoiced more than voiced consonants

In the present study, the results suggested that the frequency of occurrence of disfluent unvoiced consonants occurred significantly higher than voiced consonants only in the bilingual- Kannada group of CWS. This could be because of the transition from unvoiced to voiced phonemes with the addition of a vowel in Kannada, which is a syllabic language, unlike English. The results are in consensus with Jayaram (1983) where he found that both monolingual and bilingual AWS had more disfluencies on unvoiced consonants in reading and spontaneous speech. Though, differences existed with regard to participant group in both the studies, interestingly similar findings have been found.

5.4.1.4. Disfluent phonemes based on place of articulation

Overall, the results of the present study suggested that the frequency of occurrence of disfluent consonants considering place of articulation revealed a similar trend across both groups (mono & bilingual) in Kannada language. The findings interpreted from the most frequent to least frequent disfluent consonants included, retroflex (/ʈ/, /ɖ/, /ɳ̊/, /ɭ/), alveolars (/s/, /r/, /l/), palatals (/dʒ/, /tʃ/, /j/, /ʃ/), velars (/k/, /g/), labials (/p/, /b/, /m/, /v/), dentals (/θ/, /ð/, /n/) and glottal (/h/). It can be concluded that retroflex sounds were the most disfluent category of consonants while the glottal was the least disfluent for both the groups among CWS in Kannada language. Retroflex consonants are produced with a complete closure of the articulators obstructing the airway and hence require more effort in production unlike the other consonants which are produced with a relatively free articulatory pathway. This may be a probable factor accounting for a higher stuttering frequency on retroflex sounds in Kannada language across both mono and bilingual groups. Glottal was the least disfluent phoneme category perhaps because they are easy sounds, produced with a relatively unoccluded vocal tract (Bernthal & Bankson, 1988).

Further, among bilingual- English CWS the most frequent to least frequent disfluent consonants in English included palatals, dentals, labials, velars, alveolars, retroflex and glottal. It can be concluded that palatals were the most disfluent category of consonants while the glottal was the least disfluent among bilingual- English CWS. Though the rank order of categories varied with regard to place of articulation, the results suggested no significant difference across both languages, with the exception of retroflex.

The phonetic difficulty of consonants with reference to places of articulation revealed similar pattern of phonetic difficulty in both the groups in Kannada language, but not so in English language. Despite providing a ranking of phonetic difficulty according to places of articulation, individual variations in the data corpus were more pronounced than the group tendency towards such a phonetic ranking. It is well known that stuttering is a highly variable disorder and hence variability would also exist with phonetic attributes of stuttering.

Hahn (1942) reported that consonants such as /g/, /d/, /l/, /θ/, /tʃ/ and /m/ tended to be stuttered more frequently than consonants such as /s/, /f/, /ʃ/, /w/ and /ð/. These results lend partial support to the present study as greater occurrence of palatals (/tʃ/) and labial (/m/) in English language was found. It supports the notion of Hunt (1967) who remarked that the labial and alveolar sounds as /f/, /w/ and /s/ were less difficult phonetically as the closure of the oral cavity is not as severe as that required for the production of plosives. Interestingly, lower frequency of disfluencies was noted for the alveolar category in the English language even in the present study. An Index of Phonetic Complexity (IPC) proposed by Jakielshi (1998) indicated easy and difficult sounds for consonants based on place of articulation. It attributes to labials, coronals (dental, alveolar, palatal /ʃ/) and glottal as easy sounds and dorsals (velars, palatal /tʃ/, /dʒ/, /j/) as difficult sounds. It is apparent from the results of the current study that the labial and dental sounds occurred relatively lower in Kannada and glottal sounds had the least disfluencies in both the languages. This conforms to the concept of easy sounds according to IPC. Palatals were most stuttered in English language which corresponded to the class of difficult sound according to IPC.

On comparison of the current findings of disfluent phonemes based on place of articulation to the study by Soumya and Sangeetha (2011), who noted the rank order of difficulty as palatals, labials and velars in Kannada. The findings of the present study exhibited some similarity with respect to the above study. Similarly, in English language, present findings revealed nearly similar results only for palatal and dental groups.

To conclude, a similar pattern in occurrence of instances of stuttering with regard to places of articulation across the ML and BL CWS groups in Kannada language was noted. However, the pattern varied across languages. Hence, the phonetic attributes related to stuttering exhibited mixed results, suggesting detailed experimental procedural adaptation cross linguistically. Byrd et al. (2007) evidenced that young CWS were slower in segmental processing of individual phonemes than typically developing peers. Relating these findings to our study, CWS may probably present with specific phonetic complexity due to presence of delayed segmental processing. Researchers explained that "during the disfluencies that characterize stuttering, the speech motor system fails to generate and/or send the motor commands to muscles that are necessary for fluent speech to continue" (Olander et al., 2010). The phonetic attributes, therefore, may not always be consistent within or across PWS.

5.4.1.5. Disfluent consonants based on manner of articulation

The results of the present study suggested that the occurrence of disfluent consonants, considering manner of articulation, revealed that fricatives, nasals, affricates, stops, and laterals showed identical pattern between ML and BL groups in Kannada language, with the exception of flap and continuants. It was inferred that flap was the most disfluent category of consonants while the fricatives and nasals were the least disfluent in BLK and MLK respectively. The frequency of occurrence of disfluent consonants according to manner of articulation in English among BL CWS, from most to least frequently disfluent were, affricates, flap, fricatives, laterals, nasals, continuants and stops. It can be concluded that affricates were the most disfluent category of consonants while the stops were the least disfluent. Further, the analysis between languages (in BL CWS) revealed that the categories of affricates, fricatives, flap, laterals and nasals varied significantly.

The present study is in partial agreement with the findings by Hahn (1942), Brown (1945) and Taylor (1966). As per Jakielski's (1998) Index of Phonetic Complexity (IPC) stops, and nasals were easy sounds and fricatives, affricates and flap (/r/) were difficult sounds. The hierarchy of IPC factors leading to stuttering in English as proposed by Howell, Au-Yeung, Yaruss and Eldridge (2006) noted the "relative ordering of factors that included consonant by manner, consonant by place, word length and contiguous consonants (multisyllabic)". While comparing the present results of frequency of occurrence of disfluent sounds with the IPC measure, it was observed that, in Kannada language, the fricatives and nasals were least disfluent and flap (/r/) and continuants were most disfluent. It is apparent that a partial agreement exists for phonemes as easy and difficult while correlating the same with the occurrence of most and least disfluencies considering manner of articulation. In English language, the continuants and stops were least disfluent and affricates, flap and fricatives were most disfluent. It suggests that the IPC measures probably support the increased occurrence of disfluencies of affricates, flap and fricatives as difficult sounds in English language.

The present study showed that stops, fricatives and nasals categories were the least to occur, which is in contrast to Geetha (1979) who noted more stuttering on stops (/k/, /b/), nasals (/m/, /n/) and fricative (/h/). In Jayaram's (1983) study, the bilingual AWS presented with more disfluencies on initial nasals whereas monolingual AWS did not show such a difference in Kannada language. It was also found that significant differences were not present between the languages of bilingual AWS in the distribution of stuttering on different sound groups and fricatives had more disfluencies in both adult groups. Contrary to Jayaram's study the current results showed that the flap was most disfluent compared to other categories in both mono and bilingual CWS. One of the probable reasons for differences across the studies could be due to the differences with participant group, as we considered children between the ages of 6-8 years. The findings of Soumya and Sangeetha (2011) relate to some similarity concerned to the groups such as affricates only and not to other categories with respect to manner of articulation. Further, in the English language similarity existed for affricates and fricatives in the current study.

The findings of the current study can also be discussed in light of research pertaining to evoked potentials such as the mismatch negativity (MMN) in adults with persistent developmental stuttering (PDS) by Corbera et al. (2005). They found normal MMN potentials in response to simple tone contrasts while a noteworthy supratemporal left-lateralized enhancement of this potential was noted in response to phonetic contrasts. The authors postulated that this abnormal speech sound representation may be the underlying cause of their fluency disorder. The link between abnormal neural traces to speech sounds in the auditory cortex and disfluencies of speech supports the significance of the speech perception mechanisms to speech production. The results of this study are important in this context as the phonemes that are frequently stuttered by children might exhibit abnormal neural traces which develop as the instances of stuttering increase, as noticed in persisting developmental stuttering.

The results of the present study varied from most of the earlier studies which could probably be due to difference in the framework of analysis. The present study considered CWS, spontaneous speech task, classification of sounds based on place and manner of articulation and the analysis included parametric and nonparametric test which depended on the presence of normality. Majority of the studies on phonetic influences were performed for reading, with the exception of Geetha (1979), Hejna (1963), Jayaram (1983) and Sheehan (1974). With regard to the participant group, majority of the studies considered adults, while the present study included children instead.

It is explained that "during the disfluencies that characterize stuttering, the speech motor system fails to generate and/or send the motor commands to muscles that are necessary for fluent speech to continue" (Olander et al., 2010). Watkins, Smith, Davis, and Howell (2008) noted that "stuttering is a disorder related primarily to disruption in the cortical and subcortical neural systems supporting the selection, initiation and execution of motor sequences necessary for fluent speech production". Similarly, as stated by Packman et al. (2007), “developmental stuttering is a problem in syllable initiation in which the child is unable to move forward in speech because the speech planning system is compromised”. In reality, various factors might be contributing towards the instances of stuttering, though the degrees of importance probably might vary from each other. Additional research is required to identify the weightage of individual factors that account for the diverse levels of phonetic difficulty found in CWS.

5.4.1.6. Disfluent vowels

The frequency of occurrence of disfluent short and long vowels, vowels based on position and height of the tongue did not vary significantly in monolingual and bilingual groups indicating a similar trend in both the groups. A comparison within each group indicated significant difference between back vowels compared to front and central vowels; mid vowels compared to high and low vowels; diphthongs compared to total vowels in both the groups in Kannada language. In monolingual group, long vowels were more frequently disfluent than short vowels whereas in bilingual English group, mid vowels were significantly more disfluent than high vowels while the remaining comparisons across categories remained non-significant. It was also found that the total diphthongs were significantly higher compared to total vowels in both the languages. Comparing across languages, none of the vowel categories varied significantly in the bilingual group suggesting a similar trend. The results of the present study revealed 16-19% disfluencies on total vowels in monolingual, bilingual- Kannada and bilingual-English groups.

These results support earlier findings (Hahn, 1942; Hunt, 1967; Van Riper, 1971) that not only does stuttering occur on consonants but may extend to all other sounds such as vowels too. Wingate considers the repetitions or blocks on the consonants are only due to the actual difficulty encountered in saying the consecutive sound which is almost invariably a vowel (or diphthong). Thus, he considers stuttering to be the attempted production of a stressed vowel and feels that the shaping movements that discern one vowel from the next may contribute to the occurrence of an instance of stuttering.

Vowels are sounds produced with an un-constricted vocal tract such that there is no air pressure built up at any point above the glottis. In majority of the languages vowels constitute the syllable nucleus or peak of syllables. In the present study the monolingual group exhibited more disfluencies on long vowels compared to shorter ones which could probably be due to complexity of the vowels. The results are in agreement with that of Jayaram (1977) who reported that short vowels are less affected than long vowels. A study by Soumya and Sangeetha (2011) on bilingual CWS also noted similar trend. The results of the present study suggesting more disfluencies on back vowels is supported by Hunt (1967), who confirmed stuttering to occur on the back vowels /u/, /o/ than front vowels /e/, /I/. Geetha (1979) also noted that low back vowel /a/ had higher disfluency rate.

In the present study mid vowels (/e/, /o/, /ɔ/) exhibited increased disfluencies compared to other categories, suggesting difficulty with mid vowels compared to high and low vowels among the CWS. Also, diphthongs occurred markedly compared to total vowels in both the languages, suggesting a similar trend in both Kannada and English. Monophthongs are simple whose quality remains constant across the duration of the vowel and are sometimes known as "pure" or "stable" vowels. Diphthongs are complex as they are produced by a continuous motion of the tongue in succession from the first vowel to the next.

Further, a significant difference was not present while considering the disfluencies among the vowel categories across languages, Kannada and English. An extensive research on phonetic determinants have taken place since decades and the studies report higher instances of stuttering on consonants than on vowels. Also, most of the work has been concentrated on consonants only and limited studies are available focussing on vowels.

5.4.1.7. Disfluencies based on phoneme position

The results regarding the phoneme position suggested similar pattern of disfluencies in the monolingual and bilingual groups in both Kannada and English languages. It suggests that the rank order of the frequency of disfluencies with regard to phoneme position included initial position compared to medial position and was not present in final position in both the groups.

In agreement to the present study, Natke et al. (2004) showed that 97.8% of stuttering occurred on first syllables of words and 76.5% on the first sound of syllables, demonstrating an obvious word-initial effect. The findings are further supported by many authors (Bloodstein, 1995; Boomer, 1965; Holmes, 1988; Maclay & Osgood, 1959; Sheehan, 1974; Wingate, 2002; Watson et al., 2007) in CWS, AWS in English, Spanish and other languages.

Stuttering occurs mainly at the beginning of part of the word and/or words in a sentence probably due to "anticipatory priming". The first activating node simultaneously primes further nodes in a word and the priming of last node constitutes "anticipatory priming". According to Stromsta (1986) the deficient anticipatory coarticulation is possibly the primary element in the core behaviour of stuttering. "The sequential coordination of voice, respiration, and articulation is actually disrupted during fluent as well as non-fluent utterances. PWS are less able to repeat the temporal pattern of a sentence compared to normals, as if their neural clocks are less accurate or more susceptible to mistiming" (Cooper & Allen, 1977). To conclude, the results of the current study are in absolute concurrence with previous research indicating that the presence of disfluencies almost definitely occurred on the initial position of words.

5.4.2. Morphological Determinants

The morphological influences included the analyses of frequencies of occurrence of disfluent words with regard to word class and word length. The results of these sections are discussed as follows.

5.4.2.1. Disfluencies based on word class

The mean frequency of content words were found to be significantly greater compared to function words in monolingual and bilingual groups in Kannada and bilingual group for English language. The rank order of the frequency of disfluencies within the content word categories included; nouns, verbs, adjectives and adverbs and across languages with the exception of adverbs which were highly disfluent in Kannada compared to English. The rank order with regard to function words included; pronouns, conjunctions, prepositions, auxiliary verbs and articles in monolingual group and a similar trend was found in bilingual group of CWS in Kannada language. Similarly, the rank order included pronouns, prepositions, conjunctions, auxiliary verbs and articles in bilingual group in English language.

In agreement with this, a high degree of relationship has been reported by numerous studies with increased occurrences of stuttering on content word categories (Brown, 1938; Howell et al., 1999). It is known that content words occur less frequently compared to function words. Dayalu et al. (2002) reported a statistically significant increase of 16% in disfluencies on content words in AWS as against function words when presented in isolation. They explained the differences between content and function words with respect to adaptation effect. However, in the present study increased stuttering frequency on content words was seen in spontaneous speech (in context) which evidences a complex process. It is known that function words are restricted in number but are used more frequently with recurring use leading to adaptation and therefore better fluency on these words. The function words constitute as much as 50% of the words in a typical conversation. Dayalu et al. (2002) speculated that a more 'generalized' adaptation effect is evidenced with function words and that it differs from transitory adaptation. A 'generalized' adaptation effect leads to more easy access, processing and production of function words compared to content words.

Further, the content words belong to an open linguistic class as they are dynamic in nature, expanding and constantly evolving into newer words. On the contrary, function words belong to the closed linguistic class, as they are more frequently used, linguistically simpler, more predictable and present with restricted information (Kucera

& Francis, 1967; Landau & Jackendoff, 1993). Function words contain a set of recurrently used words, generally short and monosyllabic, in majority of the languages. The differences exist even with regard to prosodic characteristics, like they are comparatively less stressed, having flatter fundamental frequency contour and lesser vowel shifts than content words (Bard & Anderson, 1983). These differences probably are the reasons for increased frequency of stuttering on content words. Within the content word categories, greater occurrence of disfluencies was seen on nouns and verbs. The mean percentage of disfluencies on nouns and verbs appeared to be 64% to 66% and 22% to 23% respectively. The nouns have an extremely important role in conveying semantic information. Supporting the current study, Juste et al. (2012) found higher occurrence of SLDs on verbs in Portugese CWS. The verb category is acquired later in language development, and is syntactically and morphologically more complicated (Bates et al., 1991; Berndt et al., 1997; Bi et al., 2005; Honincthun & Pillon, 2005). Also, in consensus with the present study, Samadi (2001) reported that Persian CWS aged 6–10 years were more disfluent on content words. Wingate (2002) demonstrated the utility of the content/function distinction and emphasized the role of stress between the two. A majority of the content word categories incorporated stress while only in certain circumstances the function word category had stress. Probably for this reason mostly content words were affected though some percentages of function words were also affected in the present study, ranging from 13% to 16%.

Congruent with present findings, few studies (Au-Yeung et al., 1998; Bernstein, 1981; Bloodstein & Grossman, 1981) found that function words at the initial position of a sentence were frequently stuttered than content words. Sentences that begin with function words, especially pronouns and conjunctions, may also be linked with increased demand on linguistic planning and greater propositionality.

In the present study the mean percentage of disfluencies on articles among function words was around 9% to 12% and is in agreement with Lima (2002) who found that Portuguese CWS exhibited a greater occurrence of SLDs on articles, which constitutes of single syllables that determine the grammatical aspects for the succeeding noun. Literature does suggest that the single syllable word repetitions are more common in the speech of CWS. “Prepositions are acquired later in language development, and their use increases with age. Like articles, prepositions tend to begin the phrases and therefore are more vulnerable to disfluencies” (Bloodstein, 1995; Wingate, 1979).

Au-Yeung et al. (1998) indicated increased disfluencies on function words compared to content words in young CWS. The authors noted that the “function words that occupy an early position in a phonological word had higher rates of disfluency than those that occur later in a phonological word. Secondly, function words that precede the content word have higher rates of disfluency than that followed the content word. Thirdly, young speakers exhibit high rates of disfluency on function words, but this drops off with age and, correspondingly, disfluency rate on content words increases”. Supporting this view point, the present study evidenced more stuttering on content words as the participants were between the ages of 6-8 years and not young CWS. According to them the occurrence of stuttering on function words relates to the ‘delaying tactic’ used by CWS as a compensation for the unavailability of the plan for the next content word. The disfluencies on content words are due to intrinsic factors of the word, specifically concerned to phonological complexity. As the content word is not wholly ready due to incomplete planning, disfluencies tend to occur on the onset or the beginning portion of the word. They comment that the disfluencies on function and content words are complementary to each other. That is, repeating function words prevent disfluencies on content words and vice versa. This emphasis on the temporal aspects of planning and execution is congruent with another study that investigated the neuronal basis of childhood stuttering. Sommer et al. (2002) noted perturbed temporal activation in the speech-language brain areas of individuals with persistent developmental stuttering.

Earlier studies on various languages such as English (Howell et al., 1999) and Spanish (Au-Yeung et al., 2003) found comparable patterns of disfluency. Regardless of languages, young speakers were primarily disfluent on function words compared to content words. In addition, the authors reported that the occurrence of disfluencies on function words during childhood may probably be due to immature speech planning system. These authors also argued that disfluency occurs if an individual speaks fast enough to execute one segment before the plan for the next is prepared. Therefore, fluency failure can be viewed as a sign of asynchrony between the planning and execution processes.

The Covert Repair Hypothesis by Postma and Kolk (1993) proposed that the activation of phonological targets have longer latencies in PWS. They draw conclusions based on the Connectionist model by Dell and O'Seaghdha (1992). This model assumes that when a speaker plans to execute a target word, the phonologically-related competing word is also simultaneously activated. During the initial stages of activation, both the target and competing words incorporate comparable trajectories. Afterwards, on asymptote, the target word achieves greater activation levels, thereby ensuring the generation of the target unit as output. Under time constraints, a speaker has to articulate in the time frame when the two words (target and competing word) have comparable activation trajectories. Furthermore, the early stage of activation would be prolonged in a sluggish phonological system. This leads to a higher probability of speech errors, as the speaker has to generate a word in the prolonged early stage of activation. The authors propose that the inappropriate selection of words typically occurs on content words. Thus, the CRH provides some explanation as to why the function words that frequently precede content words (which are the actual source of error) are most often disfluent.

Overall in the present study a statistically significant increase in disfluencies were found on content words as opposed to function words. However, a small percentage of function words also exhibited instances of stuttering. Disfluency patterns in Kannada and English appear to operate equivalently in the present study. The findings of higher stuttering frequency with either content or function word types as per the literature may be confounded by an imbalance of linguistic factors, such as word length, phonetic factor, word stress, word familiarity, and information load within the word categories (Dayalu et al., 2002). Further studies are required on the properties of content words such as phonetic elements and usage of stress in order to understand the contribution of linguistic properties that operates across the two languages.

5.4.2.2. Disfluencies based on word length

The occurrence of disfluencies based on word length suggested no significant difference in monolingual and bilingual groups. Analysis indicated the rank order as > 6 syllables, >4 to 6 syllables, >2 to 4 syllables and 1 to 2 syllables in both the groups. The mean frequency of disfluencies for word length with >4 to 6 syllables was found to be significantly greater followed by >2 to 4 syllables and 1 to 2 syllables in bilingual CWS in English language. Though the percentage of disfluencies varied significantly across languages, similar trends were observed. The findings indicated an increased percentage of disfluencies with increased number of syllables in a word.

The results are in agreement with other studies. Rommel et al. (2000) reported greater disfluencies for longer sentences and words in German CWS. Several studies have noted that longer and/or more syntactically complex utterances have a increased tendency to be stuttered (Gains et al., 1991; Logan & Conture, 1997; Logan & LaSalle, 1999; Sawyer et al., 2008; Watkins et al., 1999; Weiss & Zebrowski, 1992; Yaruss, 1999; Zackheim & Conture, 2003). Increased length and complexity have been associated to greater processing demands and PWS are more susceptible to such demands (Bosshardt, 2006).

The comparison of results across languages suggested few differences with number of syllable or word length. Syllables are organized phonological units constituting of vowels and consonants. It was found that the CWS produced the words with the maximum of 6 syllables word length in English language while in Kannada language word length accounted to >6 syllables. The mean frequency of disfluencies was greater for word length with >2 to 4 syllables and >4 to 6 syllables in English compared to Kannada language, with the exception of 1 to 2 syllables. These differences suggest variability in the syllable structure between the languages. Kannada is a syllabic language with the presence of almost equal number of consonants and vowels in a word, with the exception of complex word; whereas, English is a stressed language with lot of variability in the distribution of consonants and vowels in a word. Moreover, in English language, the frequencies of occurrence of vowels are comparatively limited compared to Kannada, suggesting a complexity in syllabic structure. English consists of a very wide range of syllable types. Every English vowel can function as the nucleus of a syllable. English allows up to three consonants in the onset of a monosyllabic word. However, when the syllable consists of more than a single consonant, there are limitations as to which consonants can be placed together (Delahunty & Gavey, 2003). Probably for this reason the disfluencies were greater for word length of >2 to 4 syllables and >4 to 6 syllables in English compared to Kannada language. The findings indicated an increased percentage of disfluencies with increased number of syllables in a word.

Logan and LaSalle (1999) noted that for CWS, utterances with disfluency clusters included more syllables and clausal constituents as compared to fluent utterances. These results suggest linguistic complexity and utterance length as probable factors contributing to breakdown in fluency, thus supporting a multifactorial, dynamic model of stuttering. Analyzing the similar principle to CWS the participants may exhibit even more breakdown with increased word length due to an immature system compared to AWS. It is apparent that utterance length may be related to increased efforts in execution as well as planning. Chon et al. (2012) also reiterated that more the number of linguistic elements more the demands placed on speech motor control which in turn results in SLDs and slower rate. Supporting the earlier viewpoint on word length, a study by Watson et al. (2011) examined variables such as utterance length, syntactic complexity, and grammatical correctness on stuttering in young monolingual Spanish children. In accordance with previous studies, disfluent words were lengthier, frequently grammatically incorrect and included more number of clauses.

Furthermore, the findings of the present study can be interpreted with the Demands–Capacities Model (DCM) of stuttering (Starkweather & Gottwald, 1990). The authors of DCM model of stuttering argue that, “when internal or external demands for fluency exceed a child's capacities in one or more areas of development (e.g., linguistic, cognitive, motoric, emotional), stuttering is likely to occur”. This suggests that the disfluencies tend to increase as CWS produce long and grammatically complex utterances (e.g., Bernstein Ratner & Sih, 1987; Logan & Conture, 1997; Melnick & Conture, 2000; Weiss & Zebrowski, 1992).

The influence of complexity and length on disfluencies provides empirical proof for psycholinguistic theories of stuttering. It can be interpreted that disfluencies arise from the deficits in syntactic, phonological, or suprasegmental encoding (Bernstein Ratner, 1997; Perkins et al., 1991; Postma & Kolk, 1993). However, the morphological determinants of stuttering relates to word length, complexity, word class, lexical stress, frequency, phonological structure and others where the correlation with each other makes it difficult to establish the most predictive correlate of stuttering instance.

5.4.3. Syntactic Determinants

The syntactic influences included the analyses of frequencies of occurrence of disfluent words with regard to sentence structure and length. The results of these sections are discussed as follows.

5.4.3.1. Disfluencies based on sentence structure (Noun and Verb phrase)

The results of the present study regarding disfluencies based on sentence structure in specific to noun and verb phrase suggested a similar pattern in both ML and BL groups in Kannada language. The mean frequency of disfluent verb phrases were found to be significantly greater compared to noun phrases. In addition, a similar trend was found in BL group across languages. Thus, the overall results suggested almost similar pattern with regard to the occurrence of disfluencies in categories of noun and verb phrases in the groups considered under study.

The reason for such results is due to the classification of sentence structure as noun phrase and verb phrase. A noun phrase comprised of a proper noun or a pronoun or an adjective that described the noun. A verb phrase included more number of word classes such as a verb, noun and the modifier. It was noted that the verb phrase tended to be longer and included more word classes specific to content and function words compared to noun phrase. In the earlier section of analyses on morphological determinants of disfluencies the content words had predominantly greater occurrence of disfluencies and a small percentage of function words also exhibited disfluencies. The results is in agreement with Bernstein's (1981) hypothesis that utterances beginning with verb-phrases were more prone to be disfluent.

The effect of syntactic complexity of noun and verb phrases on the occurrence of stuttering in 4-6 year Persian speaking CWS were examined by Ahanger et al. (2013). The group analyses showed significant differences between fluent and stuttered utterances in terms of syntactic complexity of noun and verb phrase structures. Also, the results confirm that at phrasal level, among the noun phrases, based on their three functions as subject, direct object and object of preposition, there is a meaningful relationship between the number of subject and object of preposition with the stuttering frequency. In verb phrases, based on the presence of the auxiliary verb, copula verb, and negative prefix, there is a meaningful relations between the presence of the auxiliary verb and the stuttering frequency. Their research findings indicated that, in Persian-speaking children, there is a meaningful relation between the variable of syntactic complexity, based on noun and verb phrase structure and the variable of stuttering frequency. In the present study, the comparisons of disfluencies were performed between the noun and verb phrases, whereas Ahanger et al. (2013) compared within each type of phrases in a sentence.

5.4.3.2. Disfluencies based on sentence length

The results regarding the occurrence of disfluencies based on sentence length suggested no significant difference in monolingual and bilingual groups indicating a similar trend in both the groups. Analysis indicated the rank order as >9 words, >6-9 words, >3-6 words, and 2-3 words in a sentence in both the groups. In addition, similar results were noted in bilingual group across the Kannada and English languages. The findings indicated an increased percentage of disfluencies with increased number of words in a sentence. The results of the current study are in concurrence with other studies. The association between stuttering and other linguistic factors has been studied at sentence-level. Several authors have reported that longer utterances and/or syntactically complex sentences are at a greater probability of being stuttered (Gaines et al., 1991; Logan & Conture, 1997; Logan & LaSalle, 1999; Sawyer et al., 2008; Watkins et al., 1999; Weiss & Zebrowski, 1992; Yaruss, 1999; Zackheim & Conture, 2003).

Rommel et al. (2000) evidenced longer and syntactically more complex sentences with SLDs and ODs. An increased sentence length and syntactic complexity encompasses a comparatively higher demand on linguistic planning and may lead to an increase in disfluencies. According to O'Connell and Kowal (2005) disfluencies are an inherent part of speech and one's capacity to regulate the natural disfluencies is a vital feature of speech-language acquisition.

The findings of the present study lend support to the findings of Tornick and Bloodstein (1976), who considered 20 pairs of sentences with one set of short sentences and the other set of long sentences. The initial segments of each of the long sentences constituted the short sentences. It was found that the same words were appreciably more disfluent when they occurred in initial position of long sentences than when they occurred in isolation or in short phrases. These findings lend support to the role of motor planning, or anticipated motor complexity in fluency disorders. The increased stuttering was supposed to be caused by the speaker's perception of greater length of the long sentences. This may present some support to either anticipatory struggle or breakdown views of stuttering.

It has been portrayed that when the length of a sentence is held constant, PWS were found to exhibit more stuttering in the initial clause of the sentence compared to the same clause in final position (Jayaram, 1984). Earlier studies have shown that longer structure of the sentence may have a negative impact on speech production (Kleinow & Smith, 2000; Tsiamtsiouris & Cairns, 2009). A probable reason for this is that speakers plan their utterances earlier than actual production leading to processing costs which is linked to overloading the resources on hand for effortless speech production (Bosshardt, 1995; Starkweather & Gottwald, 1990; Yaruss, 1999). Such processing cost taxes a vulnerable speech motor system and might reasonably lead to instability with the speech motor control and hence result in greater disfluencies (Smits-Bandstra & De Nil, 2007; Van Lieshout & Goldstein, 2008). In other terms, breakdown in fluency is expected to occur if the demands for fluent speech production exceed the speaker's ability for the same. This is in alignment with Rispoli's (2003) suggestion that children have a comfortable zone, which allows for easier planning and execution of linguistic information. When demands for linguistic competence exceed the child’s comfort zone, fluency is compromised. In less technical terms, if the cost of planning and constructing a grammatical structure is high, then the construction of a complex phrase may be an overwhelming challenge for the speech production system. The upshot of such a challenge is a collapse in the coordination of various functions of the speech and language system, critical for speech motor stability, and the instigation and effortless flow of speech (Kleinow & Smith, 2000; Namasivayam & Van Lieshout, 2011; Rispoli & Hadley, 2001; Tsiamtsiouris & Cairns, 2009). These findings offer substantial evidence to the multifactorial model of stuttering and demonstrate that increases in sentence length invariably lead to greater variability in the speech output of PWS.

The effects of utterance length and complexity on mean length of utterance (MLU) was examined by Zackheim and Conture (2003). They reported that the “match” between the “linguistic diversity of an utterance” (length and complexity), and the slow-evolving “linguistic maturity of an utterance” (MLU) influences the fluency of an individual’s utterances. Congruent with these findings, sentences with greater than 9 words had more stuttering instances compared to other sentence length such as >6-9 words, >3-6 words and 2-3 words.

Contrary to current study findings, Howell and Au-Yeung (1995) found no significant difference on sentence length but stuttering tended to occur on complex syntactic structures. In addition, Bernstein Ratner and Sih (1987) noted that syntactic complexity and not utterance length, significantly correlated with the occurrence of fluency breakdown in young children. However, these findings related to sentence length and complexity should not be taken to imply that these would necessarily exert a causal influence on disfluency.

SUMMARY AND CONCLUSION

It is widely known that both stuttering and language are closely associated, but the nature of such associations is not very well understood. Till date, studies have not investigated both the language abilities and the various linguistic determinants in the same group of participants, especially in the bilingual context. Thus, it calls for further research in considering the enormous linguistic variability. The present study was hence planned with the main aim of a systematic and comprehensive evaluation of the language abilities, patterns of disfluencies and linguistic variability in ML and BL CWS. The specific objectives of the present study were to investigate the patterns of disfluencies, severity of stuttering, linguistic differences, if any, in the moments of stuttering with respect to phonetic, morphological and syntactic variables in ML and BL (Kannada and English) CWS. In addition the language abilities were compared across CWS and CWNS in ML and BL contexts.

A total of 120 participants in the age range of 6-8 years, comprising of 4 groups were considered in the present study. Group 1 included 35 ML CWS having Kannada as their mother tongue and studying in a Kannada medium schools. Group 2 included 25 BL CWS with Kannada as the primary language and studying in English medium schools and exposed to English for more than two years. Group 3 and 4 included age and gender matched ML and BL normal children respectively. The detailed procedure included 2 phases. Phase 1 included collecting detailed history from the parents as per the questionnaire developed for the study, administering Language use questionnaire to determine the usage of second language, and eliciting the speech samples across various tasks in Kannada and English languages. Phase 2 included administrations of speech-language tests selected for the study including LPT and computerized version of re-standardized KAT on ML CWS and CWN, ELTIC and EAT on BL CWS and CWNS; and SSI-3 on ML and BL CWS.

The data analysis included three different aspects. The first one included the assessment of the type and severity of disfluencies in ML and BL CWS. Secondly, the language ability was analyzed for LPT and ELTIC across and within groups of ML and BL CWS and CWNS. Finally, linguistic analyses with respect to phonetic, morphological and syntactic determinants during the instances of stuttering in ML and BL CWS and across languages were performed. The results of these analyses were compared across mono and bilingual groups and CWS and CWNS to answer research objectives.

The summary of results is highlighted below:

1. The stuttering like disfluencies, other disfluencies and degree of severity seem to present a similar trend in both groups of ML and BL CWS, and across languages.
2. The language measures analyzed and compared between CWS and CWNS using LPT indicated that ML CWS performed poorer on total syntax, total language, and few subsections of semantics compared to CWNS. On the contrary, BL CWS performed similar to their peer groups on major sections of LPT, except homonymy. Both the groups demonstrated the full range of language abilities as poor, average, and superior.
3. The language measures analyzed and compared between ML and BL CWS indicated mixed findings across various sections of LPT where the ML CWNS consistently exhibited higher scores on certain subsections of LPT compared to BL CWNS. Overall, the results revealed mixed findings sometimes favouring the ML, sometimes the BL, and sometimes both exhibiting a similar pattern.
4. The language abilities with regard to second language on ELTIC demonstrated identical performance in BL CWS and CWNS.
5. The language abilities in Kannada language measured on LPT indicated that ML CWS with moderate stuttering performed better than those with severe degree of stuttering. However, such differences were not found in BL CWS between degrees of stuttering in both Kannada and English languages.
6. The results on linguistic influences on disfluencies revealed the following:
   (i) The frequency of occurrence of disfluent consonants was significantly higher compared to disfluent vowels in ML and BL CWS and across languages.
   (ii) The disfluent clusters were significantly higher than disfluent consonants in both the groups in Kannada language. Further in BL group, a significant increase of disfluent clusters was found in Kannada compared to English.

(iii) The occurrence of disfluent voiced and unvoiced consonants presented a similar pattern among majority of CWS except BL CWS in Kannada language.

(iv) The frequency of occurrence of disfluent consonants considering place of articulation revealed the most and least frequent disfluent consonants as retroflex and glottal respectively in Kannada language (ML and BL CWS). Further, among BL- English CWS the most frequent and least frequent disfluent consonants included palatals and glottal respectively. The comparison across both languages indicated that only retroflex category was more disfluent in Kannada compared to English.

(v) Analysis of disfluent consonants according to manner of articulation from most and least frequent included flap and nasals in the ML CWS. Similarly, in BL Kannada group, flap was the most disfluent category of consonants while fricatives were the least disfluent. However, in English language affricates was most frequent and stops were least frequent. Further, the analysis between languages revealed that the categories of affricates, fricatives, flap, laterals and nasals varied significantly in both languages.

(vi) The frequency of occurrence of disfluent short and long vowels, vowels based on position and height of the tongue did not vary significantly in ML and BL group indicating a similar trend. In both the groups, back vowels were more disfluent compared to front and central vowels; mid vowels were more disfluent compared to high and low vowels; and diphthongs were more disfluent compared to total vowels. Comparing across languages none of the vowel categories varied significantly in the BL group suggesting a similar trend.

(vii) The rank order of the frequency of disfluencies with regard to phoneme position included initial followed by medial position in both the ML and BL groups of CWS and across languages.

(viii) The analyses of morphological determinants with respect to word class indicated that the mean frequency of content words were found to be significantly greater compared to function words in all groups. The rank order of the frequency of disfluencies within the content word categories included; nouns, verbs, adjectives and adverbs. The rank order with regard to function words included; pronouns, conjunctions, prepositions, auxiliary verbs and articles in ML and BL groups of CWS and almost similar results across languages.

(ix) The analyses of morphological determinants with respect to word length indicated that the frequency of occurrence of disfluencies suggested the rank order as > 6 syllables, > 4 to 6 syllables, > 2 to 4 syllables and 1 to 2 syllables in all the groups of CWS. The findings revealed an increased percentage of disfluencies with increased number of syllables in a word.

(x) The syntactic determinants with respect to sentence structure suggested that the verb phrases were more disfluent compared to noun phrases in both the groups of CWS and between languages.

(xi) The syntactic determinants with respect to sentence length suggested that the frequency of occurrence of disfluencies showed the rank order as > 9 words, > 6 to 9 words, > 3 to 6 words, and 2-3 words in a sentence in both the groups and between languages. The findings indicated an increased percentage of disfluencies with increased number of words in a sentence.

Following conclusions can be drawn with respect to hypothesis stated in the present study:

1. Hypothesis 1: The null hypothesis (H0) that there would be no differences with regard to patterns of disfluencies, and severity of stuttering in mono and bilingual CWS is accepted.
2. Hypothesis 2: The null hypothesis (H0) that there would be no differences in the language abilities across degrees of severity of stuttering using LPT in ML CWS is rejected. Therefore, the alternative hypothesis would be that there is a significant difference for total language score of the LPT across degrees of severity in ML CWS. Further, the null hypothesis that there would be no

difference on language abilities across degrees of severity in BL CWS is accepted.

3. Hypothesis 3: The null hypothesis (H0) that there would be no differences in the language abilities using LPT in ML and BL CWS and ML and BL CWNS is rejected. Therefore, the alternative hypothesis would be that there is a significant difference in language abilities in subgroups of ML and BL children.
4. Hypothesis 4: The null hypothesis (H0) that there would be no differences on comparison of language abilities in the second language using ELTIC in bilingual CWS and CWNS is accepted.
5. Hypothesis 5: The null hypothesis (H0) that there would be no differences in the phonetic determinants between mono and bilingual CWS in Kannada language is accepted. However, the same is rejected on comparison between languages in BL CWS. The alternative hypothesis would be that there is a significant difference for few phonemes with respect to place and manner of articulation among subgroups of BL CWS across languages.
6. Hypothesis 6: The null hypothesis (H0) that there would be no differences with regard to morphological determinants including word class and word length between mono and bilingual children and across two languages in bilingual CWS is accepted.
7. Hypothesis 7: The null hypothesis (H0) that there would be no differences with regard to syntactic determinants including sentence structure and sentence length between mono and bilingual children and across two languages in bilingual CWS is accepted.

The findings of the present study have made valuable contribution to the understanding of language abilities in ML and BL CWS and CWNS. Additionally, the findings have contributed to the understanding of patterns of disfluencies and linguistic determinants in ML and BL CWS. The study emphasizes the focus of assessment of CWS including a broad and detailed analysis of frequency and types of disfluency as well as many other factors such as the linguistic determinants and language abilities of CWS. It was found that for few linguistic determinants variability existed supporting the viewpoint of “Variability as the hallmark of stuttering”. Accordingly, the specific behaviours in CWS should be measured as it varies from one child to another. The probability of occurrence of stuttering is actually determined by many factors outside the motor system, including linguistic, cognitive, and emotional factors. The moments of stuttering are complicated events which involve the motor execution process as well as higher level functions of the speech planning system. The developmental stuttering is related to one or more temporal misalignments in the processes that underlie speech and language production. These specifically relate to temporal misalignments between phonetic, morphological, and syntactic aspects of language. However, other factors such as the rate at which strings of sounds or syllables are activated for selection and the rate of production of these strings of syllables also seem to play an important role on stuttering behaviours.

Implications of the study

A systematic and comprehensive evaluation of linguistic determinants adds to the growing body of literature on cross-linguistic studies in CWS. To our knowledge, this is the first effort to study the patterns of disfluencies, language abilities and linguistic determinants in the age range of 6-8 years across two groups, monolingual and bilingual children with stuttering in the Indian context. This cross-linguistic study revealed few common and differential characteristics relating to fundamental connections between stuttering and linguistic aspects of the languages. This research proves the fact that stuttering disorder, from a psycholinguistic point of view, is dependent on the language structure and use.

The SLPs while dealing with bilingual CWS should have an understanding how these children vary in one or more languages one is using. The present findings are clinically important and suggest the need to assess the language skills and its influence on stuttering. The study would enable the SLPs to be equipped and trained in the unique challenges while dealing with bilingual CWS, as it has both diagnostic and therapeutic implications. The individuals’ language abilities in the two languages, especially in very young CWS, have to be assessed in detail so that any language specific difficulties could be dealt with. The therapeutic implications specifically involve moving from very simple, short utterances to longer and complex utterances, improving smooth initiation and transitions at the word level for specific phonemes through the rate control strategies, which could be tailor-made for individual PWS, depending on the difficulty with respect to specific phonemes. It is hoped that the study might assist theorists, researchers and clinicians in arriving at some understanding of relating stuttering to language and linguistic determinants.

Limitations of the study

The acquisition of speech and language can take place over several years but the data used in the present study was restricted to only two years (6-8 years). Stuttering is highly variable and should be assessed in various contexts. In the present study tasks included spontaneous speech, picture description and narration task. However, the reading task was not used since the age range of the participants was such that the reading skills are still developing. Further, the data collection for studying the linguistic determinants of stuttering did not control for the contexts in which each of the linguistic factors could be ideally studied. However, various tasks used such as picture description, included every phoneme of the Kannada and English languages at word and sentence levels. Also, proportions of fluent and disfluent phonemes/utterances for majority of the sub categories of linguistic factors were taken into consideration for each participant to ensure appropriate distribution.

Future directions

The detailed examination of patterns of disfluencies, language abilities and linguistic determinants in monolingual and bilingual CWS at near age of onset of stuttering may be helpful in understanding the relationship between stuttering and language. A longitudinal study of the relation between stuttering and language from age of onset of stuttering till the stage of stabilized pattern of stuttering would improve our understanding about the nature of stuttering. The role of linguistic variables in monolingual and multilingual context in PWS in different age and gender groups, including adults, would throw more light on the complex interaction of motoric and linguistic influences on stuttering. Future studies could focus on both descriptive and experimental investigations to look for the nature of linguistic and motoric difficulties in stuttering.

REFERENCES

Abercrombie, D (1976). *Elements of General phonetics*, Chicago: Aldine Pub. Co.

Adams, M. R. (1978). Further analysis of stuttering as a phonetic transition defect. *Journal of Fluency Disorders*, *3*(4), 265-271.

Adams, M. R. (1990). The demands and capacities model I: Theoretical elaborations. *Journal of Fluency Disorders*, *15*(3), 135-141.

Adesope, O., Lavin, T., Thompson, T., & Ungerleider, C. (2010). A systematic review and meta-analysis of the cognitive correlates of bilingualism. *Review of Educational Research, 80*(2), 207 – 245.

Ahangar, A. A., Bakhtiar, M., Mohammadi, M., & Kavaki, M. S. (2013). The study of the effect of syntactic complexity of noun and verb phrase structure on the occurrence of stuttering in 4-6 year pre-school stuttering Persian children. *Journal of Rehabilitation, 14*, 1-4.

Al-Tamimi, F., Khamaiseh, Z., & Howell, P. (2013). Phonetic complexity and stuttering in Arabic. *Clinical Linguistics and Phonetics*, *27*(12), 874-887.

Ambrose, N. G., & Yairi, E. (1999). Normative disfluency data for early childhood stuttering. *Journal of Speech, Language, and Hearing Research*, *42*(4), 895-909.

Ambrose, N., Cox, N., & Yairi, E. (1997). The genetic basis of persistent and recovered stuttering, *Journal of Speech, Language, and Hearing Research, 40,* 567-580.

Ambrose, N., Yairi, E., & Cox, N. (1993). Genetic factors in childhood stuttering. *Journal of Speech and Hearing Research, 36,* 701-706.

Anderson, J. D. (2008). Age of acquisition and repetition word priming effects on picture naming in children who stutter, *Journal of Fluency Disorders*, *33,* 135–155. http://dx.doi.org/10.1016/j.jfludis.2008.04.001

Anderson, J. D., & Byrd, C. T. (2008). Phonotactic probability effects in children who stutter. *Journal of Speech, Language, and Hearing Research*, *51*(4), 851-866.

Anderson, J. D., & Conture, E. G. (2000). Language abilities of children who stutter. *Journal of Fluency Disorders*, *25,* 283–304.

Anderson, J. D., Pellowski, M. W., & Conture, E. G. (2005). Childhood stuttering and dissociations across linguistic domains. *Journal of Fluency Disorders*, *30*(3), 219-253.

Anderson, J. D., Wagovich, S. A., & Hall, N. E. (2006). Nonword repetition skills in young children who do and do not stutter. *Journal of Fluency Disorders*, *31*(3), 177-199.

Andrews, G. (1984). The epidemiology of stuttering. In R. Curlee & W. Perkins (Eds.), *Nature and treatment of stuttering* (pp. 1-12). San Diego, CA: College Hill.

Andrews, G., & Harris, M. (1964). *The syndrome of stuttering.* London: Heinemann.

Andrews, G., Hoddinott, S., Craig, A., Howie, P., Feyer, A. M., & Neilson, M. (1983). Stuttering: A review of research findings and theories circa 1982. *Journal of Speech and Hearing Disorders*, *48*(3), 226-246.

Andrews, G., & Neilson, M. (1981). *Stuttering: A state of the art seminar.* Paper presented at the Annual Conference of the American Speech-Language-Hearing Association, Los Angeles, CA.

Anthony, A., Bogle, D., Ingram, T., & McIsaac, M. W. (1971). *The Edinburgh articulation test*. Churchill Livingstone.

Arndt, J., & Healey, E. C. (2001). Concomitant disorders in school-age children who stutter. *Language, Speech, and Hearing Services in Schools*, *32*(2), 68-78.

Arnold, H. S., Conture, E.G., & Ohde, R. N. (2005). Phonological neighbourhood density in the picture naming of young children who stutter: Preliminary study. *Journal of Fluency Disorders, 30,* 125-148.

Au-Yeung, J., Gomez, I. V., & Howell, P. (2003). Exchange of disfluency with age from function words to content words in Spanish speakers who stutter. *Journal of Speech, Language, and Hearing Research*, *46*(3), 754-765.

Au-Yeung, J., Howell, P., & Pilgrim, L. (1998). Phonological words and stuttering on function words. *Journal of Speech, Language, and Hearing Research*, *41*(5), 1019-1030.

Au-Yeung, J., Howell, P., Davis, S., Charles, N., & Sackin, S. (2000). *UCL survey on bilingualism and stuttering*. Paper presented at the 3rd World congress on Fluency Disorders, Nyborg, Denmark, 7-11.

Au-Yeung, J., Vallejo-Gomez, I., & Howell, P. (2003). Exchange of disfluency with age from function words to content words in Spanish speakers who stutter. *Journal of Speech, Language, and Hearing Research, 46*(3), 754–765.

Bajaj, A. (2007). Working memory involvement in stuttering: Exploring evidence and research implications. *Journal of Fluency Disorders, 32,* 218–238.

Bard, E. G., & Anderson, A. H. (1983). The unintelligibility of speech in children. *Journal of Child Language*, *10*(02), 265-292.

Bates, E., Chen, S., Tzeng, O., Li, P., & Opie, M. (1991). The noun-verb problem in Chinese aphasia. *Brain and language*, *41*(2), 203-233.

Bauerly, K. R., & Gottwald, S. R. (2009). The dynamic relationship of sentence complexity, childhood stuttering and grammatical development. *Contemporary Issues in Communication Sciences and Disorders, 36*, 14-25.

Bauman, J., Hall, N.E., Wagovich, S., Weber-Fox, C., & Bernstein Ratner, N. (2012). Past tense marking in the spontaneous speech of preschool children who do and do not stutter: A preliminary investigation. *Journal of Fluency Disorders*, *37*, 314-324.

Bedore, L. & Peña, E. (2008). Assessment of bilingual children for identification of language impairment: Current findings and implications for practice. *International Journal of Bilingual Education and Bilingualism, 11,* 1-29.

Beena, M. (2014). Language abilities in preschool children with stuttering. *Unpublished Masters Dissertation, University of Mysore, Mysore, India.*

Berndt, R. S., Mitchum, C. C., Haendiges, A. N., & Sandson, J. (1997). Verb retrieval in aphasia. Characterizing single word impairments. *Brain and Language*, *56*(1), 68-106.

Bernstein Ratner, N. (1981). Are there constraints on childhood disfluency*? Journal of Fluency Disorders, 6*, 341-350.

Bernstein Ratner, N. (1997). Stuttering: A psycholinguistic perspective. In R. Curlee & G. Siegel (Eds.), *Nature and treatment of stuttering: New directions* (2nd ed.). (pp. 99–127). Boston, MA: Allyn & Bacon.

Bernstein Ratner, N., & Sih, C. C. (1987). Effects of gradual increases in sentence length and complexity on children's dysfluency. *Journal of Speech and Hearing Disorders*, *52*(3), 278-287.

Bernstein Ratner, N., & Benitez, M. (1985). Linguistic analysis of a bilingual stutterer. *Journal of Fluency Disorders, 10*(3), 211-219.

Bernstein Ratner, N., & Silverman, S. (2000). Parental perceptions of children's communicative development at stuttering onset. *Journal of Speech, Language, and Hearing Research*, *43*(5), 1252-1263.

Bernstein Ratner, N., Newman, R., & Strekas, A. (2009). Effects of word frequency and phonological neighborhood characteristics on confrontation naming in children who stutter and normally fluent peers. *Journal of Fluency Disorders, 34(*4*),* 225-41.

Bernthal, J. E., & Bankson, N. W. (1988). *Articulation and phonological disorders* (2nd ed.). Englewood Cliffs, NJ: Prentice Hall.Berry, M. F. (1938). A common denominator in twinning and stuttering. *Journal of Speech and Hearing Disorders, 3,* 51-57.

Bhuvaneswari, N. & Jayashree, C. S. (2011). English Language Test for Indian Children (ELTIC). *Student research at AIISH (Articles based on dissertation done at AIISH), 8*, 182-189.

Bi, Y., Han, Z., Shu, H., & Caramazza, A. (2005). Are verbs like inanimate objects? *Brain and Language, 95,* 28-29.

Bialystok, E. (1988). Levels of bilingualism and levels of linguistic awareness. *Developmental Psychology, 24*, 560–567.

Bialystok, E. (2009). Bilingualism: The good, the bad, and the indifferent. *Bilingualism: Language and Cognition*, *12*, 3–11.

Bialystok, E., Craik, F. I. M., & Luk, G. (2008). Lexical access in bilinguals: Effects of vocabulary size and executive control. *Journal of Neurolinguistics*, *21*, 522-538.

Bialystok, E., Luk, G., Peets, K. F., & Yang, S. (2010). Receptive vocabulary differences in monolingual and bilingual children. *Bilingualism: Language and Cognition*, *13*, 525-531.

Blood, G. W., Ridenour, V. J., Qualls, C. D., & Hammer, C. S. (2003). Co-occurring disorders in children who stutter. *Journal of Communication Disorders, 36,* 427-448.

Bloodstein, O. (1974). The rules of early stuttering. *Journal of Speech and Hearing Disorders*, *39*(4), 379-394.

Bloodstein, O. (1981). *A handbook on stuttering*. The National Easter Seal Society: Chicago, IL.

Bloodstein, O. (1995). *A handbook on stuttering* (5th ed.). San Diego, CA: Singular Publishing Group, Inc.

Bloodstein, O. (2001). Incipient and developed stuttering as two distinct disorders: Resolving a dilemma. *Journal of Fluency Disorders*, *26*(1), 67-73.

Bloodstein, O. (2006). Some empirical observations about early stuttering: A possible link to language development. *Journal of Communication Disorders*, *39*(3), 185-191.

Bloodstein, O., & Bernstein Ratner, N. (2008). *A handbook on stuttering* (6th ed.). Clifton Park, NY: Thomson Delmar.

Bloodstein, O., & Gantwerk, B. F. (1967). Grammatical function in relation to stuttering in young children. *Journal of Speech, Language, and Hearing Research*, *10*(4), 786-789.

Bloodstein, O., & Grossman, M. (1981). Early stuttering some aspects of their form and distribution. *Journal of Speech, Language, and Hearing Research*, *24*(2), 298-302.

Bluemel, C. S. (1930). *Mental Aspects of Stuttering*. Baltimore: Williams and Wilkins.

Bock, K., & Levelt, W. (1994). Grammatical encoding. In M. A. Gernsbacher (Ed.). *Handbook of Psycholinguistics*. (pp. 945-984). San Diego: Academic Press.

Bohman, T. M., Bedore, L. M., Pena, E. D., Mendez-Perez, A., & Gillam, R. B. (2010). What you hear and what you say: Language performance in Spanish-English bilinguals. *International Journal of Bilingual Education and Bilingualism, 13(3),* 325-344.

Bonelli, P., Dixon, M., Ratner, N. B., & Onslow, M. (2000). Child and parent speech and language following the Lidcombe Programme of early stuttering intervention. *Clinical Linguistics and Phonetics*, *14*(6), 427-446.

Boomer, D. S. (1965). Hesitations and grammatical encoding. *Language and Speech, 8,* 148–158.

Bosshardt, H. G. (1995). Syntactic complexity, short-term memory and stuttering. In *ASHA Convention in Orlando, FL*.

Bosshardt, H. G. (2006). Cognitive processing load as a determinant of stuttering: Summary of a research programme. *Clinical Linguistics and Phonetics*, *20*(5), 371-385.

Brenner, N. C., Perkins, W. H., & Soderberg, G. A. (1972). The effect of rehearsal on frequency of stuttering. *Journal of Speech, Language, and Hearing Research*, *15*(3), 483-486.

Browman, C. P., & Goldstein, L. (1990c). Tiers in articulatory phonology, with some implications for casual speech. In J. Kingston and M.E. Beckman (Eds.). Papers in laboratory phonology I: between the grammar and physics of speech (pp. 341-376). Cambridge: Cambridge University Press.

Brown, S. F. (1938). Stuttering with relation to word accent and word position. *Journal of Abnormal and Social Psychology, 33*, 112 – 120.

Brown, S. F. (1945). The loci of stuttering in the speech sequence. *Journal of Speech Disorders, 10,* 181–192.

Brown, S. F., & Moren, A. (1942). The frequency of stuttering in relation to word length during oral reading. *Journal of Speech Disorders*, *7*(2), 153-159.

Brundage, S. B., & Ratner, N. B. (1989). Measurement of stuttering frequency in children's speech. *Journal of Fluency Disorders*, *14*(5), 351-358.

Buhr, A., & Zebrowski, P. (2009). Sentence position and syntactic complexity of stuttering in early childhood: A longitudinal study. *Journal of Fluency Disorders*, *34*(3), 155-172.

Byrd, C. T., Conture, E. G., & Ohde, R. N. (2007). Phonological priming in young children's picture naming: Holistic versus incremental processing. *American Journal of Speech-Language Pathology, 16,* 43-53.

Byrd, K., & Cooper, E. B. (1989). Expressive and receptive language skills in stuttering children. *Journal of Fluency Disorders*, *14*(2), 121-126.

Chang, S. E., Erickson, K. I., Ambrose, N. G., Hasegawa-Johnson, M. A., & Ludlow, C. L. (2008). Brain anatomy differences in childhood stuttering. *Neuroimage*, *39*(3), 1333-1344.

Chang, S. E., Ohde, R. N., & Conture, E. G. (2002). Coarticulation and formant transition rate in young children who stutter. *Journal of Speech, Language, and Hearing Research*, *45*(4), 676-688.

Chon, H., Sawyer, J., & Ambrose, N. G. (2012). Differences of articulation rate and utterance length in fluent and disfluent utterances of preschool children who stutter. *Journal of Communication Disorders*, *45*(6), 455-467.

Colburn, N., & Mysak, E. D. (1982b). Developmental disfluency and emerging grammar: Co- occurrence of disfluency with specified semantic–syntactic structures. *Journal of Speech and Hearing Research, 25*, 421–427.

Conture, E.G. (1990). *Stuttering (*3rd ed.) New Jersey: Prentice Hall.

Conture, E. G. (2001). *Stuttering: Its nature, diagnosis, and treatment*. Allyn & Bacon.

Conway, J. K., & Quarrington, B. J. (1963). Positional effects in the stuttering of contextually organized verbal material. *The Journal of Abnormal and Social Psychology*, *67*(3), 299-301.

Cook, F. (1997). Stammering: a multifactorial disorder. In RCSLT *Bulletin*, November issue, 10 -11.

Cooper, E. B. (1993). Red herrings, dead horses, straw men, and blind alleys: Escaping the stuttering conundrum. *Journal of Fluency Disorders, 18*, 375 –387.

Cooper, M. H., & Allen, G. D. (1977). Timing control accuracy in normal speakers and stutterers. *Journal of Speech, Language, and Hearing Research*, *20*(1), 55-71.

Corbera, S., Corral, M. J., Escera, C., & Idiazábal, M. A. (2005). Abnormal speech sound representation in persistent developmental stuttering. *Neurology*, *65*(8), 1246-1252.

Core, C., Hoff, E., Rumiche, R., & Senor, M. (2011). Total and conceptual vocabulary in Spanish–English bilinguals from 22 to 30 months: Implications for assessment. *Journal of Speech, Language, and Hearing Research*, *56(5*), 1637-1649.

Craig, A., Hancock, K., Tran, Y., Craig, M., & Peters, K. (2002). Epidemiology of stuttering in the community across the entire life span. *Journal of Speech, Language, and Hearing Research*, *45*(6), 1097-1105.

Crystal, D. (1969). *Prosodic Systems and Intonation in English*. Cambridge, MA: Cambridge U.P.

Curlee, R. F. (1985). Training students to work with stutterers. In *Seminars in Speech and Language*, 6(2), 131-143. Thieme Medical Publishers, Inc.

Curlee, R. F. (2000). Demands and capacities versus demands and performance. *Journal of Fluency Disorders*, *25*, 329-336.

Curlee, R. F., & Siegel, G. M. (1997). *Nature and Treatment of Stuttering. New Directions*, 2nd ed., 204-217). Boston: Allyn & Bacon.

Dale, P. (1977). Factors related to disfluent speech in bilingual Cuban–American adolescents. *Journal of Fluency Disorders, 2*, 311–314.

Dalton, P., & Hardcastle, W. J. (1977). *Disorders of fluency and their effects on communication*. Edward Arnold: London.

Dayalu, V. N., Kalinowski, J., Stuart, A., Holbert, D., & Rastatter, M. P. (2002). Stuttering frequency on content and function words in adults who stutter: A concept revisited. *Journal of Speech, Language, and Hearing Research*, *45*(5), 871-878.

Deepa, A., & Savithri, S. R. (2011). Restandardization of Kannada articulation test**.** *Student research at AIISH (Articles based on dissertation done at AIISH), 8*, 53-65.

De Nil, L. F. (1995). *Linguistic and motor approaches to stuttering: Exploring unification*. A panel presentation at the Annual Convention of the American Speech-Language-Hearing Association, Orlando, FL.

De Nil, L. F. (1999). Stuttering: neuro-physiology perspective. In N. Bernstein Ratner & C. Healey (Eds.), *Stuttering Research and Practice: Bridging the Gap* (pp. 85-102). Mahwah, NJ: Erlbaum.

Delahunty, G., & Gavey, J. (2003). *English word stress patterns*. Retrieved from http://www.lamar.colostate.edu

Dell, G. S. & O'Seaghdha P. G. (1992) Stages of lexical access in language production. *Cognition, 42*, 287-314.

Dworzynski, K., & Howell, P. (2004). Predicting stuttering from phonetic complexity in German. *Journal of Fluency Disorders*, *29*(2), 149-173.

Dworzynski, K., Howell, P., Au-Yeung, J., & Rommel, D. (2004). Stuttering on function and content words across age groups of German speakers who stutter. *Journal of Multilingual Communication Disorders, 2*(2), 81-101.

Eisenson, J. (1984). Stuttering as an expression of inefficient language development. In L. J. Raphael, C. B. Raphael, & M. R. Vasovinos (Eds.). *Language and Cognition: Essays in honor of Arthur Bronstein (*pp. 59-72). New York: Plenum.

Fiedler, P., & Standop, R. (1983). *Stuttering: Integrating theory and practice.* Rockville, Maryland: Aspen.

Fletcher, J. M. (1928). *The problem of stuttering: A diagnosis and a plan of treatment*. Longmans, Green and Company.

Fransella, F. (1972) *Personal Change and Reconstruction: Research on a Treatment of Stuttering*. London: Academic Press.

Gaines, N. D., Runyan, C. M., & Meyers, S. C. (1991). A comparison of young stutterers' fluent versus stuttered utterances on measures of length and complexity. *Journal of Speech, Language, and Hearing Research*, *34*(1), 37-42.

Gardner, M. (1990). *Expressive One-Word Vocabulary Test– Revised*. Novato, CA: Academic Therapy Productions.

Geetha, Y. V. (1979). Some linguistic aspects of stuttering in Kannada. *An unpublished Master's dissertation. University of Mysore*.

Geetha, Y. V. (1996). A comparative study of stuttering behavior. *An unpublished Doctoral thesis. University of Mysore.*

Glover, S. (2004). Separate visual representations in the planning and control of action. *Behavioral and Brain Sciences, 27,* 3-78.

Gollan, T. H., Montoya, R. I., Cera, C., & Sandoval, T. C. (2008). More use almost always a means a smaller frequency effect: Aging, bilingualism, and the weaker links hypothesis. *Journal of Memory and Language, 58(3),* 787–814.

Gordon, P. A. (1991). Language task effects: A comparison of stuttering and nonstuttering children. *Journal of Fluency Disorders*, *16*(5), 275-287.

Gracco, V. L., & Lofqvist, A. (1994). Speech motor coordination and control: evidence from lip, jaw, and laryngeal movements. *The Journal of Neuroscience*, *14*(11), 6585-6597.

Graham, C. G. Conture, E, G. & Camarata, S. M. (2004). Childhood Stuttering on Function and Content Words. *On-line proceedings of ASHA Convention*. Disponível em URL: <http://convention.asha.org/handouts.cfm>.

Greenbaum, S. (2005). *The Oxford English Grammar, Indian edition*. Oxford University press, Oxford.

Griggs, S., & Still, A. W. (1979). An analysis of individual differences in words stuttered. *Journal of Speech, Language, and Hearing Research*, *22*(3), 572-580.

Grosjean, F. (1994). Individual bilingualism. In R.E. Asher & J. M. Simpson (Eds). *The Encyclopedia of Language and Linguistics, 3.* Oxford: Pergamon.

Guitar, B. (1998). *Stuttering: An integrated approach to its nature and treatment.* Baltimore, MD: Williams & Wilkins.

Hage, A. (2001). Is there a link between the development of cognitive– linguistic abilities in children and the course of stuttering? In H. G. Bosshardt, J. S. Yaruss, & H. F. M. Peters (Eds.), *Fluency disorders: Theory, research, treatment, and self-help. Proceedings of the Third World Congress on Fluency Disorders* (pp. 192–194). Nijmegen, The Netherlands: Nijmegen University Press.

Hahn, E. F. (1942). A study of the relationship between stuttering occurrence and phonetic factors in oral reading. *Journal of Speech Disorders*, *7*(2), 143-151.

Hakim, H. B., & Ratner, N. B. (2004). Nonword repetition abilities of children who stutter: An exploratory study. *Journal of Fluency Disorders*, *29*(3), 179-199.

Hall, N. E. (1996). Language and fluency in child language disorders: Changes over time. *Journal of Fluency Disorders*, *21*(1), 1-32.

Hall, N. E., Yamashita, T. S., & Aram, D. M**.** (1993). Relationship between language and fluency in children with language disorders. *Journal of Speech and Hearing Research, 36*, 568–579.

Hannah, E.P., & Gardner, J. G. (1968). A note on syntactic relationships in nonfluency. *Journal of Speech and Hearing Research, 11,* 853-860.

Hartfield, K. & Conture, E. (2006). Effects of conceptual and perceptual aspects of lexical priming on picture-naming of children who stutter: A preliminary study. *Journal of Fluency Disorders, 31,* 303-324.

Haynes, W.O., & Hood, S.B. (1978). Disfluency changes in children as a function of the systematic modification of linguistic complexity. *Journal of Communication Disorders, 11*, 77-33.

Hejna, R. F. (1963). Stuttering frequency in relation to word frequency usage. *American Speech and Hearing Association, 5*, 781.

Henke, W. (1967). *Preliminaries to speech synthesis based on an articulatory model. Conference preprints,* Conference on speech communication and processing, Air Force Cambridge labs. Bedford, Mass. 170-177.

Holmes, V. M. (1988). Hesitations and sentence planning. *Language and Cognitive Processes, 3*, 323–361.

Honincthun, P. & Pillon, A. (2005). Why verbs could be more demanding of executive resources than nouns: insight from a case study of a fv-FTD patient. *Brain and Language*, *95*, 36-37.

Howell, P., & Au-Yeung, J. (1995). The association between stuttering, Brown's factors, and phonological categories in child stutterers ranging in age between 2 and 12 years. *Journal of Fluency Disorders, 20*(4), 331-344.

Howell, P., & Au-Yeung, J. (2002). The EXPLAN theory of fluency control and the diagnosis of stuttering. E. Fava,, (Eds.), *Current Issues in Linguistic Theory series: Pathology and therapy of speech disorders* (pp 75 – 94). Amsterdam: John Benjamins.

Howell, P., & Au-Yeung, J. (2007). Phonetic complexity and stuttering in Spanish. *Clinical Linguistics and Phonetics*, *21*(2), 111-127.

Howell, P., Au-Yeung, J., & Pilgrim, L. (1999). Utterance rate and linguistic properties as determinants of lexical dysfluencies in children who stutter. *The Journal of the Acoustical Society of America*, *105*(1), 481-490.

Howell, P., Au-Yeung, J., & Sackin, S. (1999). Exchange of stuttering from function words to content words with age. *Journal of Speech, Language, and Hearing Research*, *42*(2), 345-354.

Howell, P., Au-Yeung, J., & Sackin, S. (2000). Internal structure of content words leading to lifespan differences in phonological difficulty in stuttering. *Journal of Fluency Disorders*, *25*(1), 1-20.

Howell, P., Davis, S., & Au-Yeung, J. (2003). Syntactic development in fluent children, children who stutter, and children who have English as an additional language. *Child Language Teaching and Therapy*, *19*(3), 311-337.

Howell, P., Davis, S., & Williams, R. (2009). The effects of bilingualism on stuttering during late childhood. *Archives of disease in childhood*, *94*(1), 42-46.

Howell, P., & Dworzynski, K. (2005). Planning and execution processes in speech control by fluent speakers and speakers who stutter. *Journal of Fluency Disorders*, *30*(4), 343-354.

Howell, P., Kadi-Hanifi, K., & Young, K. (1991). Phrase revisions in fluent and stuttering children. In H. G. M. Peters, W. Hulstijn, & C. W. Starkweather, (Eds), *Speech motor control and stuttering* (pp. 415 – 422). Amsterdam: Elsevier.

Howell, P., Ruffle, L., Fernandez-Zuniga, A., Gutiérrez, R., Fernandez, A. H., O'Brien, M. L., & Au-Yeung, J. (2004). Comparison of exchange patterns of stuttering in Spanish and English monolingual speakers and a bilingual Spanish-English speaker. *Theory, Research and Therapy in Fluency Disorders*, 415-422.

Hresko, W. P., Reid, D. K., & Hamill, D. D. (1999). *Test of early language development* (3rd ed.). San Antonio, TX: Pearson Assessment.

Hubbard, C. P., & Prins, D. (1994). Word familiarity, syllabic stress pattern, and stuttering. *Journal of Speech, Language, and Hearing Research*, *37*(3), 564-571.

Huinck, W. J., Pascal, H. H. M., van Lieshout, Peters, H. F. M., & Hulstijn, W. (2004). Gestural overlap in consonant clusters: effects on the fluent speech of stuttering and non-stuttering subjects. *Journal of Fluency Disorders*, *29*(1), 3–25.

Hunt, J. (1967). *Stammering and stuttering, their nature and treatment.* New York: Hafner Publishing Co. (Original work published in 1861).

Ivanova, Iva., & Albert, Costa. (2008). Does bilingualism hamper lexical access in speech production? *Acta Psychologica*, *127*, 277-288.

Jakielski, K. J. (1998). In Howell, P., Au-Yeung, J., Yaruss, S., & Eldridge, K. (2006). Phonetic difficulty and stuttering in English, *Clinical Linguistics and Phonetics, 20(9)*, 703–716.

Jankelowitz, D. L., & Bortz, M. A. (1996). The interaction of bilingualism and stuttering in an adult. *Journal of Communication Disorders*, *29*, 223-234.

Jayaram, M. (1977). Linguistic analysis of stuttering pattern of bilingual stutterers. *Journal of Indian Institute of Science*, *59*, 363- 370.

Jayaram, M. (1983). Phonetic influences on stuttering in monolingual and bilingual stutterers. *Journal of Communication Disorders*, *16*, 278-297.

Jayaram, M. (1984). Distribution of stuttering in sentences, relationship to sentence length and clause position. *Journal of Speech, Language, and Hearing Research*, *27*(3), 338-341.

Jayashree, C. S., & Prema, K. S. (2007). Languages of school-going children a sample survey in Mysore. *Language in India, 7.*

Johnson, W. (1959). *The onset of stuttering: Research, findings and implications*. Minneapolis: University of Minnesota Press.

Johnson, W., & Brown, S. F. (1935). Stuttering in relation to various speech sounds. *Quarterly Journal of Speech*, *21*(4), 481-496.

Juste, F., & Andrade, C. R. (2006). Typology of speech disruptions and grammatical classes in stuttering and fluent children. *Pro Fono, 18*(2), 129-140.

Juste, F. S., Sassi, F. C., & de Andrade, C. R. F. (2012). Exchange of disfluency with age from function to content words in Brazilian Portuguese speakers who do and do not stutter. *Clinical Linguistics and Phonetics*, *26*(11-12), 946-961.

Kadi-Hanifi, K., & Howell, P. (1992). Syntactic analysis of the spontaneous speech of normally fluent and stuttering children. *Journal of Fluency Disorders*, *17*(3), 151-170.

Kapa, L. L., & Colombo, J. (2013). Attentional control in early and later bilingual children. *Cognitive Development*, 28, 233–246.

Karanth, P., Ahuja, G.K., Nagaraja, D., Pandit, R., & Shivashankar, N. (1991). *Language disorders in Indian neurological patients- A study in neurolinguistics in the Indian context* (Project No. 5/8/10-1(Oto)/84-NCD-IRIS cell). Indian Council of Medical Research, NewDelhi.

Karniol, R. (1992). Stuttering out of bilingualism. *First Language, 12*, 255-283.

Karniol, R. (1995). Stuttering, language, and cognition: a review and a model of stuttering as suprasegmental sentence plan alignment (SPA). *Psychological bulletin*, *117*(1), 104.

Kelly, E. M. (2000). Modeling stuttering etiology: Clarifying levels of description and measurement. *Journal of Fluency Disorders, 25*, 359-368.

Kent, R. D. (1983). Facts about stuttering: Neuropsychologic perspectives. *Journal of Speech and Hearing Disorders*, 48, 249-255. doi:10.1044/jshd.4803.249

Kenyon, E. (1943). The etiology of stammering: The psychophysiologic facts which concerns the production of speech sounds and of stammering. *Journal of Speech Disorders*, 8, 337-348.

Kim, K. H. S., Relkin, N. R., Lee, K. M., & Hirsch, L. (1997). Distinct cortical areas associated with native and second languages. *Nature, 388*, 171-174.

Klein, D., Zatorre, R. J., Milner, B., Meyer, E., & Evans, A. C. (1994). Left putaminal activation when speaking a second language: Evidence from PET. *Neuroreport, 5,* 2295-2297.

Kleinow, J., & Smith, A. (2000). Influences of length and syntactic complexity on the speech motor stability of the fluent speech of adults who stutter. *Journal of Speech, Language, and Hearing Research*, *43*(2), 548-559.

Kloth, S. A. M., Janssen, P., Kraaimaat, F. W., & Brutten, G. J. (1998). Child and mother variables in the development of stuttering among high-risk children: A longitudinal study. *Journal of Fluency Disorders, 23,* 217-230.

Kohnert, K., Bates, E., & Hernandez, A.E. (1999). Balancing bilinguals: Lexical-semantic production and cognitive processing in children learning Spanish and English. *Journal of Speech, Language, and Hearing Research, 42* (6), 1400-1413.

Kolk, H., & Postma, A. (1997). Stuttering as a covert repair phenomenon. *Nature and treatment of stuttering: New directions*, *2*, 182-203.

Krause, R. (1982). A social-psychological approach to the study of stuttering. In C. Fraser, & K. R. Scherer. (Eds.). *Advances in the Social Psychology of Language* (pp. 77-123). Cambridge.

Kucera, H., & Francis, W. N. (1967). *Computational analysis of present-day American English*. Providence, RI: Brown University Press.

Ladefoged, J. (2001). *Sounds from Peter Ladefoged's books*. Web page: [http://hctv.humnet.ucla.edu/departments/linguistics/VowelsandConsonants]

Landau, B., & Jackendoff, R. (1993). "What" and "where" in spatial language and spatial cognition. *Brain and Behavioral Sciences, 16,* 217–265.

Larsen-Freeman, D., & Long, M. H. (1991). *An introduction to second language acquisition research.* London: Longman.

Leah, E. P., & Geetha, Y. V. (2008). Stuttering variability in Bi/Multilingual persons with stuttering. *Student research at AIISH (Articles based on dissertation done at AIISH), 6*, 164-177.

Lebrun, Y., Bijleveld, H., & Rousseau, J. J. (1990). A case of persistent neurogenic stuttering following a missile wound. *Journal of Fluency Disorders*, *15*(5), 251-258.

Lebrun, Y., & Paradis, M. (1984). To be or not to be an early bilingual? In Y. Lebrun, & M. Paradis (Eds.). *Early Bilingualism and Child Development* (pp. 9-18). Lisse: Swets & Zeitlinger.

Levelt, W. J. M. (1989). Speaking: From intention to articulation. Cambridge, MA: Bradford Books.

Lima, R. C. H. (2002). Cited in Juste, F. S., Sassi, F, C., & de Andrade, C. R. F. (2012). Exchange of disfluency with age from function to content words in Brazilian Portuguese speakers who do and do not stutter. *Clinical Linguistics and Phonetics, 26*, 946 -961.

Logan, K. J. (2001). The effect of syntactic complexity upon the speech fluency of adolescents and adults who stutter. *Journal of Fluency Disorders*, *26*(2), 85-106.

Logan, K. J. (2003). The effect of syntactic structure upon speech initiation times of stuttering and nonstuttering speakers. *Journal of Fluency Disorders*, *28*(1), 17-35.

Logan, K. J., & Conture, E. G. (1997). Selected temporal, grammatical, and phonological characteristics of conversational utterances produced by children who stutter. *Journal of Speech, Language, and Hearing Research*, *40*(1), 107-120.

Logan, K. J., & LaSalle, L. R. (1999). Grammatical characteristics of children's conversational utterances that contain disfluency clusters. *Journal of Speech, Language, and Hearing Research*, *42*(1), 80-91.

Louko, L. J., Edwards, M. L., & Conture, E. G. (1990). Phonological characteristics of young stutterers and their normally fluent peers: Preliminary observations. *Journal of Fluency Disorders*, *15*(4), 191-210.

MacKay, D. G. (1969a). The repeated letter effect in the misspelling of dysgraphics and normals. *Perc Psychophys 5*, 102 -106.

MacKay, D. G. (1970). Context-depending stuttering. *Kybernetik, 7*, 1-9.

Maclay, H., & Osgood, C. E. (1959). Hesitation phenomena in spontaneous English speech. *Word-Journal of the International Linguistic Association*, *15*(1), 19-44.

Mac Neilage, P. F. (1970). Motor control of serial ordering of speech. *Psychological Review, 77*, 182-196.

Magiste, E. (1980). Memory for numbers in monolinguals and bilinguals. *Acta Psychologica, 46*, 63-68.

Mann, M. B. (1955). Nonfluencies in the oral reading of stutterers and nonstutterers of elementary school age. In W. Johnson & R.R. Leurenneger (Eds.), *Stuttering in children and adults* (pp. 189-196). Minneapolis: University of Minnesota press.

Manning, W. (2006). Therapeutic change and the nature of our evidence: Improving our ability to help. *Current issues in stuttering research and practice*, 125-158.

Martin-Rhee, M. M., & Bialystok, E. (2008). The development of two types of inhibitory control in monolingual and bilingual children. *Bilingualism: Language and Cognition, 11*, 81–93.

Melnick, K. S., & Conture, E. G. (2000). Relationship of length and grammatical complexity to the systematic and nonsystematic speech errors and stuttering of children who stutter. *Journal of Fluency Disorders*, *25*(1), 21-45.

Melnick, K.S., Conture, E.G., & Ohde, R.N. (2003). Phonological priming in picture naming of young children who stutter. *Journal of Speech, Language, and Hearing Research, 46,* 1428–1443.

Meyers, S. C., Ghatak, L. R., & Woodford, L. L. (1989). Case descriptions of nonfluency and loci: Initial and follow-up conversations with three preschool children. *Journal of Fluency Disorders*, *14*(6), 383-397.

Millager, R. A., Conture, E. G., Walden, T. A., & Kelly, E. M. (2014). Expressive language intratest scatter of preschool-age children who stutter. *Contemporary Issues in Communication Science and Disorders: CICSD*, *41*, 110.

Muma, J. R. (1971). Syntax of preschool fluent and disfluent speech: A transformational analysis. *Journal of Speech and Hearing Research, 14,* 428-441.

Murray, H. L., & Reed, C. G. (1977). Language abilities of preschool stuttering children. *Journal of Fluency Disorders, 2*, 171–176.

Mysak, E. D. (1960). Servo Theory and Stuttering. *Journal of Speech and Hearing Disorders, 25,* 188-195.

Namasivayam, A. K., & van Lieshout, P. (2011). Speech motor skill and stuttering. *Journal of Motor Behavior*, *43*(6), 477-489.

Natke, U., Sandrieser, P., van Ark, M., Pietrowsky, R., & Kalveram, K. T. (2004). Linguistic stress, within-word position, and grammatical class in relation to early childhood stuttering. *Journal of Fluency Disorders*, *29*(2), 109-122.

Nippold, M. A. (1990). Concomitant speech and language disorders in stuttering children- A critique of the literature. *Journal of Speech and Hearing Disorders, 55*(1), 51-60.

Nippold, M. A. (2010). It's not too late to help adolescents succeed in school. *Language, speech, and hearing services in schools, 41*(2), 137-138.

Nippold, M. A., Schwarz, I. E., & Jescheniak, J. D. (1991). Narrative ability in school-age stuttering boys: A preliminary investigation. *Journal of Fluency Disorders*, *16*(5), 289-308.

Ntourou, K., Conture, E. G., & Lipsey, M. W. (2011). Language abilities of children who stutter: A meta-analytical review. *American Journal of Speech-Language Pathology, 20,* 163-179.

Nudelman, H. B., Herbrich, K. E., Hoyt, B. D., & Rosenfield, D. B. (1989). A neuroscience model of stuttering. *Journal of Fluency Disorders*, *14*(6), 399-427.

Nwokah, E. E. (1988). The imbalance of stuttering behavior in bilingual speakers. *Journal of Fluency Disorders*, *13*(5), 357-373.

O'Connell, D. C., & Kowal, S. (2005). Uh and um revisited: Are they interjections for signaling delay*? Journal of Psycholinguistic Research*, *34,* 555–576.

Olander, L., Smith, A., & Zelaznik, H. N. (2010). Evidence that a motor timing deficit is a factor in the development of stuttering. *Journal of Speech, Language and Hearing Research, 53,* 876-86.

Owens, R. E. (2012). *Language development: An introduction* (8th ed.). Upper Saddle River, NJ: Pearson.

Packman, A., Onslow, M., Richard, F., & Van Doorn, J. (1996). Syllabic stress and variability: A model of stuttering. *Clinical Linguistics and Phonetics, 10(3),* 235–263.

Packman, A., Code, C., & Onslow, M. (2007). On the cause of stuttering: Integrating theory with brain and behavioral research. *Journal of Neurolinguistics*, *20*(5), 353-362.

Paul, R. (2007). Disorders of communication. In A. Martin, & F. R. Volkmar, (Eds.), *Lewis's Child and Adolescent Psychiatry,* (pp. 418–430). Philadelphia: Lippincott Williams & Wilkins.

Pellowski, M. W., & Conture, E. G. (2005). Lexical priming in picture naming of young children who do and do not stutter. *Journal of Speech, Language, and Hearing Research*, *48*(2), 278-294.

Perani, D., Paulesu, E., Galles, N. S., Dupoux, E., Dehaene, S., Bettardini, V., Cappa, S. F., Fazio, F., & Mehler, J. (1998). The bilingual brain. Proficiency and age of acquisition of the second language. *Brain, 121*, 1841-1852.

Perkins, W. H., Kent, R. D., & Curlee, R. F. (1991). A theory of neuropsycholinguistic function in stuttering. *Journal of Speech and Hearing Research, 34*, 734–752.

Perkins, W., Rudas, J., Johnson, L., & Bell, J. (1976). Stuttering: Discoordination of phonation with articulation and respiration. *Journal of Speech and Hearing Research, 19, 509-522.*

Perozzi, J. A., & Kunze, L. H. (1969). Language abilities of stuttering children. *Folia Phoniatrica, 21*, 286–392.

Peters, H. F. M., & Starkweather, C. W. (1990). The interaction between speech motor coordination and language processes in the development of stuttering: Hypotheses and suggestions for research. *Journal of Fluency Disorders, 15,* 115-125.

Postma, A., & Kolk, H. (1993). The covert repair hypothesis: prearticulatory repair processes in normal and stuttered disfluencies. *Journal of Speech, Language and Hearing Research, 36*, 472–487.

Prachi, P. P. (2001). Syntactic abilities of children with stuttering. *Unpublished Masters Dissertation, University of Mysore, Mysore, India.*

Prins, D., & Lohr, F. (1972). Behavioral dimensions of stuttered speech. *Journal of Speech, Language, and Hearing Research, 15*(1), 61-71.

Prins, D., Main, V., & Wampler, S. (1997). Lexicalization in adults who stutter. *Journal of Speech, Language, and Hearing Research, 40*(2), 373-384.

Pushpavathi, M. (2004). Interaction of speech motor and language processes in stuttering children, *Unpublished Doctoral Thesis, University of Mysore, Mysore, India.*

Quarrington, B. (1965). Stuttering as a function of the information value and sentence position of words. *Journal of Abnormal Psychology, 70*(3), 221.

Quarrington, B., Conway, J., & Siegel, N. (1962). An experimental study of some properties of stuttered words. *Journal of Speech, Language, and Hearing Research, 5,* 387-394.

Quirk, R., & Stein, G. (1990). *English in use*. Harlow: Longman.

Quirk, R., Greenbaum, S., Leech, G., & Svartvik, J.(1985). *A comprehensive grammar of the English language.* London: Longman.

Ransdell, S. E., & Fischler, I. (1987). Memory in a monolingual mode. *Journal of Memory and Language,* 26, 392-405.

Reilly, S., Onslow, M., Packman, A., Wake, M., Bavin, E. L., Prior, M., & Ukoumunne, O. C. (2009). Predicting stuttering onset by the age of 3 years: A prospective, community cohort study. *Pediatrics*, *123*(1), 270-277.

Richels, C., Buhr, A., Conture, E., & Ntourou, K. (2010). Utterance complexity and stuttering on function words in preschool-age children who stutter. *Journal of Fluency Disorders*, *35*(3), 314-331.

Riley, G. D. (1994). *Stuttering Severity Instrument for children and adults—third edition* (SSI-3). Austin, TX:Pro-Ed.

Riley, G., & Riley, J. (1979). A component model for diagnosing and treating children who stutter. *Journal of Fluency Disorders, 4,* 279-293.

Ringo, C. C., & Dietrich, S. (1995). Neurogenic stuttering: An analysis and critique. *Journal of Medical Speech-Language Pathology*, *3*(2), 111-122.

Rispoli, M. (2003). Changes in the nature of sentence production during the period of grammatical growth. *Journal of Speech-Language and Hearing Research, 46,* 818-830.

Rispoli, M., & Hadley, P. (2001). The leading edge: The significance of sentence disruptions in the development of grammar. *Journal of Speech, Language, and Hearing Research, 44,* 1131–1143.

Robb, M., & Blomgren, M. (1996). Analysis of F2 transitions in the speech of stutterers and nonstutterers. *Journal of Fluency Disorders, 21*, 1–16.

Roberts, P. M. & Shenker, R. C. (2007). Assessment and treatment of stuttering in bilingual speakers. In E. G. Conture & R. F. Curlee (Eds), *Stuttering and Related Disorders of Fluency* (3rd edn). New York: Thieme Medical Publishers.

Roelofs, A. (2002a). Syllable structure effects turn out to be word length effects: Comment on Santiago et al. (2000). *Language and Cognitive Processes*, *17*, 1–13.

Rommel, D., Häge, A., Johannsen, H. S., & Schulze, H. (1997). Linguistic aspects of stuttering in childhood. *Speech Production: Motor Control, Brain Research and Fluency Disorders*, 603-610.

Rommel, D., Hage, A., Kalehne, P., & Johannsen, H. (2000). Developmental, maintenance, and recovery of childhood stuttering: Prospective Longitudinal data 3 years after first contact. In K. Baker & L. Rustin (Eds.), *Proceedings of the Fifth Oxford Disfluency Conference (pp. 168−182).* Windsor, Berkshire: Chappell Gardner.

Roth, F. P., & Spekman, N. J. (1986). Narrative discourse: Spontaneously generated stories of learning-disabled and normally achieving students. *Journal of Speech and Hearing Disorders, 51,* 8–23.

Ryan, B. P. (1992). Articulation, language, rate, and fluency characteristics of stuttering and nonstuttering preschool children. *Journal of Speech, Language, and Hearing Research*, *35*(2), 333-342.

Safwat, R. F., & Sheikhany, A. (2014). Parental attitudes and knowledge of stuttering. *The Egyptian Journal of Otolaryngology*. *30,* 151-156.

Salihovic, N., Junuzovic-zunic, L., Duranovic, M., Fatusic, A. (2010). Characteristics of vocabulary in school-age stuttering children. *The Journal of International Social Research, 3* (12), 399-406.

Samadi, M. (2001). *Investigating the effect of word type and word position on stuttering in 6–10 year-old Hamedan Persian children in phrase structure* (MS Thesis). Faculty of Rehabilitation Science, Iran University of Medical Sciences, Tehran, Iran.

Sander, E. K. (1972). When are speech sounds learned? *Journal of Speech and Hearing Disorders, 37*, 55–63.

Santiago, J., MacKay, D. G., Palma, A., & Rho, C. (2000). Sequential activation processes in producing words and syllables: Evidence from picture naming. *Language and Cognitive Processes, 15,* 1–44.

Sasisekaran, J., & Byrd, C. T. (2013). A preliminary investigation of segmentation and rhyme abilities of children who stutter. *Journal of Fluency Disorders, 38*(2), 222-234.

Savithri, S. R., & Jayaram, M. (2006). *Speech Rhythm in Indo-Aryan and Dravidian languages,* ARF Project, AIISH, Mysore.

Sawyer, J., Chon, H., & Ambrose, N. G. (2008). Influences of rate, length, and complexity on speech disfluency in a single-speech sample in preschool children who stutter. *Journal of Fluency Disorders*, *33*(3), 220-240.

Schlesinger, I. M., Forte, M., Fried, B., & Melkman, R. (1965). Stuttering, information load, and response strength. *Journal of Speech and Hearing Disorders*, *30,* 32-36 (1965).

Seeman, M. (1974). Cited in Van Borsel, J., Maes, E., & Foulon, S. (2001). Stuttering and bilingualism- A review. *Journal of Fluency Disorders, 26*, 179-205.

Sharf, D., & Ohde, R. (1981). Physiologic, acoustic and perceptual aspects of coarticulation: Implications for the remediation of articulation disorders. In N. Lass (Ed.), *Speech and language: Advances in basic research and practice*, (pp. Vol.5). New York: Academic Press.

Sheehan, J. G. (1974). Stuttering behavior: A phonetic analysis. *Journal of Communication Disorders*, *7*(3), 193-212.

Shenker, R. C., Conte, A., Gingras, A., Courcey, A., & Polomeno, L. (1998). The impact of bilingualism on developing fluency in a preschool child. In E. C. Healey, & H. F. M. Peters (Eds.). *Second world congress on fluency disorders proceedings*, San Francisco, August 18-22. (pp. 200-204). Nijmegen: Nijmegen University. Press.

Siegel, G. M. (2000). Demands and capacities or demands and performance? *Journal of Fluency Disorders, 25*, 321–328.

Siguan, M., & Mackay, W.F. (1987). *Education and bilingualism*. London: Kagan Page, Ltd.

Silverman, F. H., & Williams, D. E. (1967). Loci of disfluencies in the speech of stutterers. *Perceptual and Motor Skills, 24*(3c), 1085-1086.

Silverman, S., & Ratner, N. B. (2002). Measuring lexical diversity in children who stutter: Application of vocd. *Journal of Fluency Disorders*, *27*(4), 289-304.

Singhi, P., Kumar, M., Malhi, P., & Kumar, R. (2007). Utility of the WHO Ten questions screen for disability detection in rural community - the North Indian experience. *Journal of Tropical Pediatrics, 53 (6),* 383-387.

Smith, A. (1999). Stuttering: A unified approach to a multifactorial, dynamic disorder. *Stuttering research and practice: Bridging the gap*, 27.

Smith , A., & Kelly, E. (1997). Stuttering: A dynamic, multifactorial model. In R. F. Curlee & G. M. Siegel (2nd Ed.), *Nature and treatment of stuttering: New directions,* (pp. 204-217). Boston: Allyn & Bacon.

Smits-Bandstra, S., & De Nil, L. F. (2007). Sequence skill learning in persons who stutter: Implications for cortico-striato-thalamo-cortical dysfunction. *Journal of Fluency Disorders, 32,* 251–278.

Sneha, G., Shruthi, G., & Geetha, Y.V. (2008). *Variability of disfluencies in bilingual speakers with stuttering.* Presented at the 40th National Conference of Indian Speech and Hearing Association held at Mangalore.

Soderberg, G. A. (1962). What Is ‘Average Stuttering’? *Journal of Speech and Hearing Disorders*, *27*(1), 85-86.

Soderberg, G. A. (1966). The relations of stuttering to word length and word frequency. *Journal of Speech, Language, and Hearing Research*, *9*(4), 584-589.

Soderberg, G. A. (1967). Linguistic factors in stuttering. *Journal of Speech, Language, and Hearing Research*, *10*(4), 801-810.

Sommer, M., Koch, M. A., Paulus, W., Weiller, C., & Büchel, C. (2002). Disconnection of speech-relevant brain areas in persistent developmental stuttering. *The Lancet*, *360*(33), 380-383.

Soumya, G. P., & Sangeetha, M. (2011). Phonetic influences in bilingual children with stuttering. *Student research at AIISH (Articles based on dissertation done at AIISH), 9*, 258-66.

St. Louis, K., & Hinzman, A. (1988). A descriptive study of speech, language and hearing characteristics of school-aged stutterers. *Journal of Fluency Disorders*, 331-356.

St. Louis, K. O., Hinzman, A. R., & Hull, F. M. (1985). Studies of cluttering: disfluency and language measures in young possible clutterers and stutterers. *Journal of Fluency Disorders, 10, 151-172.*

St. Onge, K. (1963). The stuttering syndrome. *Journal of Speech and Hearing Research, 6*, 195-197.

Starkweather, C. W. (1987). *Fluency and Stuttering.* Englewood Cliffs, NJ: Prentice-Hall.

Starkweather, W., & Gottwald, S. (1990). The demands and capacities model II: Clinical applications. *Journal of Fluency Disorders, 15,* 143-158.

Starkweather, C. W., Hirschman, P., & Tannenbaum, R. S. (1976). Latency of vocalization onset: Stutterers vs. nonstutterers. *Journal of Speech and Hearing Research, 19, 481-492.*

Stern, E. (1948). A preliminary study of bilingualism and stuttering in four Johannesburg schools. *Journal of Logopaedics, 1,* 15-25.

Sternberg, S., Monsell, S., Knoll, R. L., & Wright, C. E. (1978). The latency and duration of rapid movement sequences: comparison of speech and typewriting. *Information processing in motor control and learning* (Ed.) G. E. Stelmach, (pp.118-152). New York: Academic Press.

Stromsta, C. (1986). *Elements of stuttering*. Atsmorts Publishing.

Suchitra, M. G. (1985). Study of co-articulation in stuttering. *Unpublished Masters Dissertation, University of Mysore, Mysore, India.*

Taliancich-Klinger, C. L., Byrd, C. T., & Bedore, L. M. (2013). The disfluent speech of a Spanish–English bilingual child who stutters. *Clinical Linguistics & Phonetics, 27*(12), 888-904.

Tanner, D. (1999). Understanding stuttering: A guide for parents. Oceanside, CA: Academic communication associates.

Taylor, I. K. (1966). What words are stuttered? *Psychological Bulletin, 65*(4), 233.

Tetnowski, J. A., Richels, C., Shenker, R., Sisskin, V., & Wolk, L. (2012). When the diagnosis is dual? *ASHA Leader, 14*.

Thordardardottir, E. (2006). Language intervention from a bilingual mindset. *The ASHA Leader, 11(10),* 20-21.

Throneburg, R. N., Yairi, E., & Paden, E. P. (1994). Relation between phonologic difficulty and the occurrence of disfluencies in the early stage of stuttering. *Journal of Speech, Language, and Hearing Research, 37*(3), 504-509.

Tomasello, M. (2003). *Constructing a Language: A Usage-Based Theory of Language Acquisition*. Cambridge, MA: Harvard University Press.

Tornick, G. B., & Bloodstein, O. (1976). Stuttering and sentence length. *Journal of Speech, Language, and Hearing Research, 19*(4), 651-654.

Travis, L. E., Johnson, W., & Shover, J. (1937). The relation of bilingualism to stuttering: a survey in the east Chicago, Indiana schools. *Journal of Speech Disorders, 12*, 185-189.

Trotter, W. D. (1956). Relationship between severity of stuttering and word conspicuousness. *Journal of Speech and Hearing Disorders, 21*, 198-201.

Tsiamtsiouris, J., & Cairns, H. S. (2009). Effects of syntactic complexity and sentence-structure priming on speech initiation time in adults who stutter. *Journal of Speech, Language, and Hearing Research, 52*, 1623-1639.

Tsiamtsiouris, J., & Cairns, H. S. (2013). Effects of sentence-structure complexity on speech initiation time and disfluency. *Journal of Fluency Disorders*, *38*(1), 30-44.

Upadhyaya, U. P. (2000). *Kannada Phonetic Reader*. Mysore: Central Institute of Indian Languages.

Vahab, M., Zandiyan, A., Falahi, M. H., & Howell, P. (2013). Lexical category influences in Persian children who stutter. *Clinical Linguistics and Phonetics*, *27*(12), 862-873.

Van Borsel, J., & de Britto Pereira, M. M. (2005). Assessment of stuttering in a familiar versus an unfamiliar language. *Journal of Fluency Disorders*, *30*(2), 109-124.

Van Lieshout, P. H. H. M., & Goldstein, L. M. (2008). Gestural phonology and speech impairments. In M. J. Ball, M. Perkins, N. Müller & S. Howard (Eds.), *Handbook of Clinical Linguistics* (pp. 467- 479). Oxford, UK: Blackwell Publishing.

Van Lieshout, P. H. H. M., Hulstijn, W., & Peters, H. F. M. (1996). From planning to articulation in speech production: What differentiates a person who stutters from a person who does not stutter? *Journal of Speech and Hearing Research*, *39*, 546–564.

Van Riper, C. (1971). *The Nature of Stuttering*. Englewood Cliffs, NJ: Prentice- Hall, Inc.

Van Riper, C. (1973). *The Treatment of Stuttering.* Englewood Cliffs, NJ: Prentice-Hall.

Van Riper, C. (1982). *The Treatment of Stuttering*. Englewood Cliffs, NJ: Prentice-Hall.

Van Riper, C. (1990). Final thoughts about stuttering. *Journal of Fluency Disorders, 15*, 317-318.

Vanryckeghem, M., Glessing, J. J., Brutten, G. J., & McAlindon, P. (1999). The main and interactive effect of oral reading rate on the frequency of stuttering. *American Journal of Speech-Language Pathology, 8*(2), 164-170.

Vassiliou, C., Stahl, V., & Gillam, R. (1997). Assessment of bilingual school-age children who stutter. *Journal of Fluency Disorders*, *2*(22), 147.

Venkatesan, S. (2006). The NIMH socio-economic status scale: Improvised version. Mysore: All India Institute of Speech and Hearing.

Wagovich, S. A., & Bernstein Ratner, N. (2007). Frequency of verb use in young children who stutter. *Journal of Fluency Disorders*, *32*(2), 79-94.

Wall, M. J. (1980). A comparison of syntax in young stutterers and nonstutterers. *Journal of Fluency Disorders, 5*(4), 345-352.

Wall, M., Starkweather, C. W., & Cairns, H. S. (1981). Syntactic influences on stuttering in young child stutterers. *Journal of Fluency Disorders. 6*, 283–298.

Wall, M. J., Starkweather, C. W., & Harris, K. S. (1981). The influence of voicing adjustments on the location of stuttering in the spontaneous speech of young child stutterers. *Journal of Fluency Disorders*, *6*(4), 299-310.

Ward, D. (2006). *Stuttering and cluttering. Frameworks for understanding and treatment*. East Sussex: Psychology Press.

Watkins, R. V. (2005). Language abilities of young children who stutter. In E. Yairi & N. Ambrose (Eds.). *Early Childhood stuttering* (pp. 235-252). Austin, TX: Pro-Ed.

Watkins, K. E., Smith, S. M., Davis, S., & Howell, P. (2008). Structural and functional abnormalities of the motor system in developmental stuttering. *Brain*, *131*(1), 50-59.

Watkins, R. V., Yairi, E., & Ambrose, N. G. (1999). Early childhood stuttering. Initial status of expressive language abilities. *Journal of Speech, Language, and Hearing Research*, *42*(5), 1125-1135.

Watson, B. C., Freeman, F. J., Devous, M. D., Chapman, S. B., Finitzo, T., & Pool, K. D. (1994). Linguistic performance and regional cerebral blood flow in persons who stutter. *Journal of Speech, Language, and Hearing Research*, *37*(6), 1221-1228.

Watson, J. B., Byrd, C. T., & Carlo, E. J. (2007). Characteristics of stuttered words in older and younger Spanish-speaking children. *American Speech-Language-Hearing Association, Boston, MA.*

Watson, J. B., Byrd, C. T., & Carlo, E. J. (2011). Effects of length, complexity, and grammatical correctness on stuttering in Spanish-speaking preschool children. *American Journal of Speech-Language Pathology*, *20*(3), 209-220.

Weber-Fox, C. (2001). Neural systems for sentence processing in stuttering. *Journal of Speech, Language, and Hearing Research*, *44*(4), 814-825.

Weinreich, U. (1953) *Languages in Contact*. The Hague: Mouton.

Weiss, A. L., & Zebrowski, P. M. (1992). Disfluencies in the conversations of young children who stutter - some answers about questions. *Journal of Speech, Language, and Hearing Research*, *35*(6), 1230-1238.

Weiss, A. L., & Zebrowski, P. (1994). The narrative productions of children who stutter: A preliminary view. *Journal of Fluency Disorders, 19,* 39-63.

Wells, G. B. (1979). Effect of sentence structure on stuttering. *Journal of Fluency Disorders, 4,* 123-129.

Westby, C. E. (1974). Language performance of stuttering and nonstuttering children. *Journal of Communication Disorders, 12,* 133–145.

Westby, C. E. (1984). Development of narrative language abilities. In G.P. Wallach & K. G. Butler (Eds.), *Language learning disabilities in school-age children* (pp. 103-127). Baltimore, MD: Williams & Wilkins.

Whalen, D. (1990). Coarticulation is largely planned. *Journal of Phonetics*, *18,* 3-35.

WHO. (1997). *International Classification of Diseases.* Geneva: World Health Organisation.

Williams, D. E., Melrose, B. M., & Woods, C. L. (1969). The relationship of stuttering and academic achievement in children. *Journal of Communication Disorders, 2,* 87-89.

Williams, D. E., Silverman, F. H., & Kools, J. A. (1969). Disfluency behavior of elementary-school stutterers and nonstutterers: Loci of instances of disfluency. *Journal of Speech, Language, and Hearing Research*, *12*(2), 308-318.

Williams, K. T. (1997). *Expressive vocabulary test* (EVT). Circle Pines, MN: American Guidance Service, Inc.

Wingate, M. E. (1964). A standard definition of stuttering. *Journal of Speech and Hearing Disorders, 29*, 484-89.

Wingate, M. E. (1967). Stuttering and word length. *Journal of Speech and Hearing Research, 10, 146-152.*

Wingate, M. E. (1969). Stuttering as a phonetic transition defect. *Journal of Speech and Hearing Disorders*, *34*, 107-108. doi:10.1044/jshd.3401.107.

Wingate, M. E. (1979). The first three words. *Journal of Speech, Language, and Hearing Research*, *22*(3), 604-612.

Wingate, M. E. (1984). Stutter events and linguistic stress. *Journal of Fluency Disorders, 9*(4), 295-300.

Wingate, M. E. (1985). Stuttering as a prosodic disorder. In R. F. Curlee & W. H. Perkins (Eds), *Nature and Treatment of Stuttering: New Directions*, San Diego, CA: College Hill Press.

Wingate, M. E. (2002). *Foundations of stuttering*. San Diego, CA: Academic Press.

Yairi, E. (1983). The onset of stuttering in two- and three-year-old children: A preliminary report. *Journal of Speech and Hearing Disorders, 48,* 171-177.

Yairi, E. (2004). The formative years of stuttering: A changing portrait. *Contemporary Issues in Communication Science and Disorders*, *31,* 92-104

Yairi, E., & Ambrose, N. (2005). *Early Childhood Stuttering*. Austin, TX: Pro-Ed.

Yaruss, J. S. (1997). Clinical implications of situational variability in preschool children who stutter. *Journal of Fluency Disorders*, *22*(3), 187-203.

Yaruss, J. S. (1999). Utterance length, syntactic complexity, and childhood stuttering. *Journal of Speech, Language, and Hearing Research*, *42*(2), 329-344.

Yaruss, J. S., & Conture, E. G. (1993). F2 transitions during sound/syllable repetitions of children who stutter and predictions of stuttering chronicity. *Journal of Speech, Language, and Hearing Research, 36*(5), 883-896.

Yaruss, J. S., LaSalle, L. R., & Conture, E. G. (1998). Evaluating stuttering in young children diagnostic data. *American Journal of Speech-Language Pathology*, *7*(4), 62-76.

Yaruss, J. S., Newman, R. M., & Flora, T. (1999). Language and disfluency in nonstuttering children's conversational speech. *Journal of Fluency Disorders*, *24* (3), 185-207.

Yashaswini, R. & Geetha, Y. V. (2011). Linguistic and metalinguistic abilities in children with stuttering. *Student research at AIISH (Articles based on dissertation done at AIISH), 8*, 302-309.

Zackheim, C. T., & Conture, E. G. (2003). Childhood stuttering and speech disfluencies in relation to children’s mean length of utterance: A preliminary study. *Journal of Fluency Disorders, 28*(2), 115-142.

Zimmermann, G. (1980). Stuttering- A Disorder of Movement. *Journal of Speech, Language, and Hearing Research*, *23*(1), 122-136.

Zipf, G. K. (1949). *Human behavior and the principle of least effort.* Cambridge, Mass.: Addison-Wesley.

Zmarich, C., & Marchiori, M. (2006). *Coarticulation and stuttering in fluent syllables under contrastive focus*, 5th International Conference on Speech Motor Control, June 7 – 10.

APPENDIX I

Questionnaire to obtain general information of CWS

Name: **Date:**
Age/ sex: **Case no:**
Tel no: **e-mail & ph:**
Address:

Referred by:
Socio economic status:

Educational history:

Medical history:

Development history:

A. Onset and development of stuttering:

1) At what age did your child begin stuttering?
   a) < 2 yrs b) 2-3 yrs c) 3-4 yrs d) 4-6 yrs e) > 6 yrs
2) Who first noticed stuttering?
   a) Mother b) Father c) Teacher d) grandparents e) others
3) Was the onset sudden/ gradual in nature?
   a) Sudden b) Gradual
4) Has your child's stuttering been cyclical?
   a) No b) Yes
5) In what situation was stuttering first noticed? Describe the circumstances..,
6) What were the first signs of stuttering?
   a) Repetition b) Prolongations c) Blocks
7) Any changes in the way stuttering have been occurring w.r.t severity.
8) Was the stuttering easy or forceful at the time when stuttering was first noticed?

B. Awareness and Variability of stuttering:

1) Is your child aware of his/her problem?
   a) Yes b) No
2) Is your child concerned about the problem?
   a) Highly concerned b) Somewhat concerned c) Not concerned
3) Does your child stutter more/less in/with certain:
   a) Situations b) Language c) Person
   Specify:

C. Etiology:

1) What do you think is the cause for your child to stutter?
   a) Familial d) Unknown
   b) Psychological e) Others (specify)
   c) Environmental

   If familial:
   - Who else in your family has stuttering? Specify.
   - Is the relation that of:

   a) First degree paternal b) First degree maternal c) Second degree paternal

d) Second degree maternal e) Others (specify)

2) Is your marriage a consanguineous one? If yes, specify the relation:
   a) Yes b) No.
3) Do you have other children with any associated problems? If yes, specify the problem.
   a) Yes b) No

D. Associated problems:

1) Does your child have any other associated problems other than stuttering?
   a) Yes b) No
2) If yes, what problem does he/she have?
   a) Articulation
   b) Language
   c) Learning
   d) Voice
   e) Psychological
   f) Others (specify)

E. ***Variability of stuttering in both the languages (for BL CWS)***

a. Does the child experience more stuttering at any sound/word specifically: Yes/No
   If yes, specify: in Kannada -
   in English -
b. How do you rate your child's stuttering in the following situation?
   1-Nil 2-Mild 3-Moderate 4-Severe

i. How much stuttering does the child experience while speaking in Kannada? - 1 2 3 4
ii. How much stuttering does the child experience while speaking in English? - 1 2 3 4
iii. How much stuttering does the child experience while reading in Kannada? - 1 2 3 4
iv. How much stuttering does the child experience while reading in English? - 1 2 3 4

F. Fluency evaluation:

1. ***SSI (Monolingual and Bilingual - Kannada)***
   Frequency: Duration: Physical concomitants:
   Total Score: Severity:
   Type of block:
   Type of secondary behaviours:
2. ***SSI (Bilingual - English)***
   Frequency: Duration: Physical concomitants:
   Total Score: Severity:
   Type of block:
   Type of secondary behaviours:
3. ***WSLD (Monolingual and Bilingual - Kannada)***
   PW: SS: RU: DP:
   Weighted SLD = [(PW + SS) x RU] + (2 x DP) =
4. ***Fluency evaluation: WSLD (Bilingual - English)***
   PW: SS: RU: DP:
   Weighted SLD = [(PW + SS) x RU] + (2 x DP) =

APPENDIX II

Consonantal phonemes of Kannada language (Upadhyaya, 2000)

Consonants based on place and manner of articulation	Bilabial	Dental	Alveolar	Retroflex	Palatal	Velar	Glottal
Stop	/p/, /b/	/θ/, /ð/		/ʈ/, /ɖ/		/k/, /g/	
Affricate					/tʃ/, /dʒ/		
Fricative		/f/	/s/, /z/		/ʃ/		/h/
Nasal	/m/	/n/		/ɳ̊/		/ŋ/	
Continuant	/v/				/j/		
Flap			/r/				
Lateral			/l/	/l̥/			

APPENDIX III

Vowels based on position and height of tongue (Upadhyaya, 2000)

Vowels	Front	Central	Back
High	/i/, /I/		/u/, /U/
Mid		/e/, /Ɛ/	/Ɔ/, /o/,/O/
Low		/Λ/, /æ/,/a/	
Dipthongs		/aI/, /ƆI/, /aU/	

APPENDIX IVa

Results of test of normality for patterns of disfluencies, phonetic, morphological and syntactic determinants in CWS

Major category	Sub categories	Normality			Major category	Sub categories	Normality		
		ML	BLK	BLE			ML	BLK	BLE
Phoneme categories	Consonants	+	+	+	Vowel categories	High	+	+	-
	Vowels	-	+	-		Mid	+	-	-
	Voiced	-	+	+		Low	-	-	+
	Unvoiced	-	+	+		Dipthongs	-	-	-
	Clusters	-	+	-					
Phoneme categories based on POA	Velars	+	+	+	Vowel categories	Short	-	+	-
	Retroflex	-	+	-		Long	-	+	+
	Dental	-	+	+		Front	+	-	-
	Labial	-	+	+		Central	-	-	+
	Glottal	-	+	+		Back	-	+	-
	Alveolar	-	+	+					
	Palatal	+	+	+					
Phoneme categories based on MOA	Stops	+	+	+	Patterns of disfluencies	SLDs	-	-	+
	Affricates	+	+	+		ODs	-	-	+
	Fricatives	-	+	+		TDs	-	-	+
	Continuants	-	+	-		WSLDs	-	-	+
	Nasals	+	+	+		SSI score	-	+	+
	Flap	-	+	+		Severity	-	-	-
	Laterals	-	+	+					
Word class	Content	-	+	+	Word length	1-2	-	+	+
	Function	+	+	-		>2-4	+	+	+
	Nouns	+	-	+		>4-6	-	+	+
	Verbs	+	-	-					
	Adjectives	-	-	+		>6	+	+	NA
	Adverbs	-	-	-					
	Prepositions	-	-	-	Sentence length	2-3	-	+	+
	Auxillary verbs	-	Only 3 subjects	-		>3-6	+	+	+
	Pronouns	+	+	+		>6-9	+	-	-
	Conjunctions	-	-	-		>9	+	-	-
	Articles	+	+	-	Phoneme position	Unequal and Limited Distribution			
Sentence Structure	Noun Phrase	+	+	+					
	Verb Phrase	+	+	+					

Note. ML = monolingual, BLK = bilingual Kannada, BLE = bilingual English, NA = not applicable, BLK = bilingual Kannada, BLE = bilingual English, POA = place of articulation, MOA = manner of articulation.

APPENDIX IVb

Results of test of normality for language abilities using LPT in ML and BL children

Major sections of LPT	Subsections of LPT	MLK		BLK	
		CWS	CWNS	CWS	CWNS
Phonology	Phonemic discrimination	-	-	-	-
	Phonetic expression	-	-	-	-
	Total phonology	-	-	-	-
Semantics	Semantic Discrimination	-	-	-	-
	Naming	-	-	-	-
	Lexical Category	+	-	-	-
	Synonymy	-	-	-	-
	Antonymy	-	-	-	-
	Homonymy	-	-	-	-
	Polar Questions	-	-	-	-
	Semantic Anomaly	-	-	-	-
	Paradigmatic Relations	-	-	-	-
	Syntagmatic Relations	-	-	-	-
	Semantic contiguity	-	-	-	-
	Semantic similarity	-	-	-	-
	Total semantics	+	+	-	-
Syntax	Morphophonemic structures	-	+	-	-
	Plural forms	-	-	-	-
	Tenses	-	-	-	
	Person number gender markers	-	-	-	+
	Case markers	-	-	-	-
	Transitives	+	-	-	-
	Sentence types	-	-	-	-
	Predicates	-	-	-	-
	Conjunctions	-	-	-	-
	Conditional clauses	-	-	-	-
	Participal constructions	+	-	-	-
	Total syntax	-	+	+	-
Overall	Total language	+	+	+	-

Note. MLK = monolingual Kannada, BLK = bilingual Kannada.

APPENDIX IVc

Results of test of normality for language abilities using ELTIC for BL children

Subsections of ELTIC	BL	
	CWS	CWNS
Total reception	-	+
Total expression	-	+
Semantic knowledge	-	+
Morphological rules	+	-
Syntactic rules	+	-
Total language	+	-