LEXICAL DIVERSITY IN CHILDREN WITH SPECIFIC LANGUAGE IMPAIRMENT

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Manasagangothri, Mysuru-570006

July 2024

CERTIFICATE

This is to certify that this dissertation entitled “Lexical Diversity in children with Specific Language Impairment” is a bonafide work submitted in part fulfilment for the degree of Masters in Science (Speech-Language Pathology) of the student Registration number: P01II22S123031. This has been carried out under the guidance of the faculty of this institute and has not been submitted earlier to any other University for an award of any other Diploma or Degree.

Mysuru
July, 2024

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DECLARATION

This is to certify that this dissertation entitled "Lexical Diversity in children with Specific Language Impairment" is the result of my own study under the guidance of Dr. Priya M. B., Assistant Professor in Speech Pathology, Centre for Speech and Language Disorders in Children, Adults and Senior Citizens, All India Institute of Speech and Hearing, Mysuru and has not been submitted earlier to any other University for an award of any other Diploma or Degree.

Mysuru
July, 2024

Registration Number: P01II22S123031

Dedicated to,

AMMA, APPA and NUPU!

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CHAPTER 1

INTRODUCTION

Effective verbal communication requires an individual to have the competence to understand and perform a verbal production that is required for a given linguistic context. Linguistic comprehension and expression abilities are acquired throughout the developmental period in childhood. Several risk factors during the prenatal (Eg: excessive vomiting, history of miscarriage, diabetes during pregnancy), natal (Eg: low birth weight, neonatal jaundice, and delayed birth cry) or postnatal (Eg: typhoid, high fever, measles) period could adversely affect speech and language development leading to delayed or deviant language skills. A language disorder could occur due to a wide array of causes and some of the most common associated problems that occur with language impairment include deficits in the intellectual, cognitive, emotional, psychosocial, sensory, motor or neurological domains of functioning (Liu et al., 2018). However, a language disorder that is characterized by difficulties only in the linguistic aspects, preserving all other domains of functioning, is named as the Specific Language Impairment (SLI) (Bishop, 2006; Ervin, 2001; Szukiel et al., 2017).

Individuals diagnosed with SLI have been reported to present with different combinations and levels of deficits in the language components, specifically, semantics (Eg: complex vocabulary and assigning semantic roles), syntax (Eg: use of different types of sentences and word order), morphology (Eg: use of tense makers and case markers), phonology (sound substitutions or deletions) and pragmatics (Eg: Inference making and turn taking) (Katsos et al., 2011; Leonard, 2003; Mainela-Arnold et al., 2010; Sheng et al., 2010).

SLI is recognised and diagnosed on the exclusionary principle by ruling out the presence of deficits in other areas of development (Szukiel et al., 2017). Considering that individuals with SLI have deficits in the different components of language, the assessment procedure should also include measures to assess these components. The different methods of assessment that is taken up for the appraisal of language deficits in individuals with SLI include parent/caregiver/teacher interviews, clinical case history taking, screening, standardized assessment tools, dynamic assessment, systematic observation, contextual analysis, ethnographic interviewing, curriculum based assessments, and language sampling analysis (Thomas et al., 2019; ASHA, n.d).

Standardised test materials are often used to assess the language levels of children with developmental language disorders [Eg: Clinical Evaluation of Language Fundamentals-5 (CELF 5) (Wiig et al., 2013) and Assessment of Language Development (ALD) (Lakkanna et al., 2021)]. Apart from these standardized assessment procedures, language sampling measures have been studied widely in SLI. Language sampling requires the clinician to transcribe the utterances of the child elicited in a naturalistic and real-life context (Calder et al., 2017; Klatte et al., 2021; Price et al., 2010) which helps in obtaining various quantitative and qualitative measures.

Some measures obtained from language sampling like Type Token Ratio (TTR), Number of different words (NDW), Number of total words (NTW) and Vocabulary Density are used as indices of lexical diversity (Miller & Klee, 1995; Miller et al., 2015; Yang et al., 2022). Lexical diversity is described as the array of different words that an individual has used in a given speech or written discourse sample (Baese-

Berk et al., 2021; Yang et al., 2022). Measures of lexical diversity hold mirror to the level of sophistication in the child's lexical system. Higher the lexical diversity, higher is the competence in the semantic domain as the child has used a wide variety of words with less repetitions. These measures are found to be increasing in magnitude with age indicating the underlying linguistic development (Baese-Berk et al., 2021).

Studies have been done to examine the potentials of the lexical diversity measures to differentiate between children who are typically developing and children with communication disorders. Based on measures of TTR and NDW, children with SLI were delineated to have fewer different words when compared to the typical group, indicating poorer lexical diversity (Watkins et al., 1995). Similarly, vocabulary density measure was found to be lower in spontaneous speech of children with SLI in comparison with their typical peers (Owens & Leonard, 2002).

The advantages of language sampling methods over the standardized assessment tools have been increasingly researched in the last two decades. In the recent years, Computed Language Sampling Analysis (CLSA) have been used in order to obtain an exhaustive, deep and detailed outcome of the language sample in a relatively shorter period of time (Arabpour et al., 2023; Calder et al., 2017). Systematic Analysis of Language transcripts (SALT) (Miller & Chapman, 2009), Sampling Utterances and Grammatical Analysis-Revised (SUGAR) (Pavelko et al., 2022), and Programs to Examine Phonetic and Phonologic Evaluation Records (PEPPER) (Weston et al., 1989) are some of the software used for language sampling procedures.

1.1 Need for the study

Language measures obtained from standardized tests have been helpful in obtaining information about the current levels of performances of a particular child. However, there are some major caveats in relying only on the standardized assessment procedures in the clinical setup. The language sample obtained while performing a standardized test may not be a true representation of the child's linguistic abilities as it does not allow linguistic analysis in a naturalistic context (Costanza-Smith, 2010). Recent studies highlight that a standardized test would not allow the child to naturally choose the vocabulary to bring out the expected responses, thereby leading to poorer performance on the test. This could also be due to the lack of exposure to the words on the test (Luckman et al., 2021).

One of the major demerits of the standardised test procedures is that it can give rise to biases associated with the normative comparison values, the test items used, the instruction given and sensitivity to cultural-linguistic aspects of the person who is being assessed (Finestack et al., 2014). On the other hand, a lexical diversity measure through language sample analysis helps us to assess the child's semantic abilities without the need for normative or standardized assessment protocols, thereby eliminating cultural and linguistic biases. The language sampling assessment procedure and analysis can be highly individualized, thus, making it culturally and linguistically sensitive (Finestack et al., 2014).

In the Indian context, it is often challenging to access standardized language test materials suitable for assessing children with language delays. In the current scenario, most of the Indian children are exposed to a minimum of two languages and hence,

bi/multilingualism is the norm. Standardized language tests are specific to a single language and may not be able to account for the code-mixing or code switching often encountered in the clinical set up. As a result, accurate estimations of the child's linguistic skills and in turn, the clinical diagnosis is questionable when only standardized tests are included in the assessment protocol.

The shortcomings of a standardized test could be overcome with the use of language sample analysis. The results of a recent study emphasised on inclusion of lexical diversity in assessment procedures undertaken in the routine clinical setup as these measures indicate the language deficits in different clinical populations (Charest et al., 2020). Depending on the sampling context (Eg: Interview setup, free play setup, home environment), differences could be observed in the syntactic or semantic features of the child's utterances (Finestack et al., 2014). This enables us to understand the extent to which the language sampling measures like lexical diversity can level up the current assessment procedures for children with SLI and other language disorders when they are done systematically. Also, there is a dearth of research on language sampling analysis in the Indian context, especially for children with language delays. Thus, the present study is designed to compare lexical diversity measures that reflect upon the richness of the child's semantic system in children with SLI and their typically developing peers.

1.2 Aim of the study

The study aimed to compare lexical diversity measures between children with SLI and children who are typically developing.

1.3 Objectives of the study

- To compare the lexical diversity measures of (a) Number of Total Words (NTW), (b) Number of Different Words (NDW), and (c) Moving Averages of Type-Token Ratio (MATTR) between the SLI group and chronological age matched typically developing group of participants.

- To compare the lexical diversity measure of (a) Number of Total Words (NTW), (b) Number of Different Words (NDW), and (c) Moving Averages of Type-Token Ratio (MATTR) between the SLI group and expressive language-age matched typically developing group of participants.

1.4 Hypotheses of the study

The study assumed null hypotheses for each of the objectives as follows:

- There is no significant difference between SLI and chronological age matched typically developing participants in the lexical diversity measures of (a) NTW, (b) NDW and (c) MATTR.

- There is no significant difference between SLI and expressive language age matched typically developing participants in the lexical diversity measures of (a) NTW, (b) NDW and (c) MATTR.

CHAPTER 2

REVIEW OF LITERATURE

SLI is a developmental language disorder which occurs because of no specific unitary cause. It is characterized by difficulties in the domains of language, namely, understanding, speaking, reading and writing (Bishop, 2006). Individuals diagnosed with SLI are recognised based on the exclusionary principle by ruling out the presence of deficits in areas of development other than language (Leonard, 1993; Szukiel et al., 2017). Therefore, assessments are done to examine and confirm the absence of deficits in other developmental domains except language, thus, following the exclusion criteria that is mentioned above and forming an ideal procedure to diagnose SLI.

2.1 Definitions of SLI

Rapin (1996) defines SLI as "*improper language acquisition by children who were not diagnosed with brain structure damage, hearing loss, considerable general impairment in learning and who were not deprived of contact with the surrounding*". One of the earliest definitions of SLI was put forth by Leonard (1998). According to this definition, SLI is a significant impairment in spoken language ability when there is no obvious accompanying condition such as mental retardation, neurological damage or hearing impairment (Leonard, 1998).

SLI is described as a condition in which a child has language impairment that is not secondary to other aspects like perceptual deficits, cognitive deficits, sensori-motor deficits, neurological deficits, emotional/psychological or behavioural deficits (Stark & Tallal, 1981). According to the SLI diagnostic criteria proposed by Stark and Tallal

(1981), to diagnose a child with SLI, the child needs to have delay of one year in the measures obtained on the domains of a language test. In specific terms, a minimum of twelve and six months delay in expressive language and receptive language, respectively, is recommended to meet the diagnostic criteria for SLI. SLI is also defined as a developmental disorder where the etiology of the language impairment remains uncertain making it difficult for the clinician to understand if it is a 'primary' language disorder (De Jong, 1999).

In the recent years, some authors describe SLI as one such language disorder that is characterized by difficulties only in the linguistic aspects that could be characterised by phonological, morphological, syntactic, semantic and pragmatic deficits; while preserving all other domains of functioning (Bishop, 2006; Ervin, 2001; Szukiel et al., 2017). More specifically, SLI can affect the development of vocabulary, grammar, discourse skills and significant difficulties in the acquiring morphology; all of which happens without marked neurological, sensory, intellectual or emotional deficits (Ervin, 2001). World Health Organization (2010) defined SLI as a condition where the language skills of a child fall more than 2 standard deviations below the mean and are at least 1 standard deviation below non-verbal skills.

2.2 Types and classification of SLI

Taxonomy and classification of SLI is yet to achieve its consensus amongst the practicing professionals and theorists. This is true even with respect to the diagnostic labels and terminologies used for the SLI population (De Jong, 1999). In spite of the theoretical discrepancies, there are some attempts made to categorize the subtypes of SLI. One of the earliest classifications of SLI was proposed by Rapin and Allen (1983).

Based on the clinical experience of the authors, the SLI population was initially classified into four variants, namely, (a) 'Verbal auditory Agnosia' (i.e inability to understand the meaning of the given auditorily input even if the person has intact auditory sensation and perception), (b) 'Semantic-Pragmatic syndrome' (i.e the characteristics overlap and cause deficits in word meaning, vocabulary, lexicality; along with pragmatic language deficits like poor discourse skills, lack of coherence and cohesion), (c) 'Autism' (this refers to a predominant impairment in socio-pragmatic skills), and (d) 'Syntactic- phonological syndrome' (i.e deficits in word order, grammatical markers, sentence types and other syntactic difficulties accompanied by poorer phonological processing, deviant or delayed phonological acquisition and atypical phonological awareness abilities).

Rapin (1998) modified the classification system by adding other phenotypes of this language impairment. This included, 'Lexical -syntactic subtype' characterized by difficulties of word retrieval and sentence comprehension, 'Dyspraxia' and 'Isolated phonological production deficit' involving the difficulty within the sound system of language (Rapin, 1998).

The initial classification of SLI as 'language syndromes' (Rapin & Allen, 1983) underwent another change during its second revision. This was marked by the elimination of 'Autism' (which was considered as semantic-pragmatic variant of SLI) from the taxonomy (Rapin, 1998). The complex overlap between 'semantic-pragmatic disorder' and 'pervasive developmental disorder-not otherwise specified' (PDD-NOS) posed further challenges to the classification system. Hypothetically, 'Pragmatic Language impairment' is described to be the equivalent of 'semantic-pragmatic

disorder' and therefore, considered to be a part of 'autistic disorder' or 'PDD-NOS' (Bishop & Norbury, 2002). However, researchers showed that it is difficult to make such direct relations between the language disorders based on its characteristic overlap (Bishop & Norbury, 2002; Bishop, 2010).

The classification proposed by Rapin and Allen (1983) was subjected to further refinement and consolidation to facilitate better understanding of the 'language syndromes' (Rapin, 1996). The six language phenotypes were consolidated into three as described below:

(a) Receptive/expressive developmental language disorder: The most obvious deficits that mark the characteristics of this subtype includes poor comprehension and expression of vocabulary, lexical items, phonological awareness, word order, sentence types, morphology, grammatical markers, word classes, and narratives. The two variants of this subtype include 'Receptive/expressive phonological/syntactic deficit syndrome' and a rarely manifested type, 'Verbal auditory agnosia'.

(b) Expressive developmental language disorder syndromes: 'Developmental verbal dyspraxia' (DVD) and 'Phonologic programming deficit syndrome' are the variants of this subtypes. Children who fall under this category have difficulties in constructing verbal linguistic productions, producing complex sounds/words, mental manipulations of phonemes, and programming the verbal utterances. Most often, speech intelligibility and naturalness get compromised due to the expressive difficulties.

(c) Higher order processing disorder: Word finding difficulties, lack of turn-taking, poor comprehension of sarcasm/jokes, inadequate narrative/discourse skills, and decreased socio-linguistic abilities characterise the third subtype. Variants such as 'Lexical deficit disorder' and 'Pragmatic language impairment' are consolidated into this subtype of SLI.

An investigation into the appropriateness of the classification of SLI using the six subtypes and the results indicated a considerable amount of stability in categorising 242 seven to eight year old SLI children using this classification system (Conti-Ramsden & Botting, 1999). However, when the seven-year-old participants were tracked for a period of one year, the appropriateness reduced in 45% of the children as there was shifting of categories within the classification system (Conti-Ramsden & Botting, 1999). Similar findings were obtained when the three consolidated subtypes of SLI was considered (Conti-Ramsden & Botting, 1999).

In view of the reduced stability of classification systems, subgrouping of SLI has gained less prominence in recent years. However, the classification of SLI from other language disorders that have coinciding language symptomology has been put to the forefront. An EpiSLI criteria was proposed by Tomblin et al. (1996) based on composite scores to classify SLI based on five aspects, further divided into 'linguistic domains' which are three in number, namely, vocabulary, grammar, narration and 'linguistic modalities', two in number; comprehension and expression. A child whose composite scores are of the lowest 10% range in two or more aspects would be identified as having a specific language disorder. Most of the other classifications and differential diagnostic procedures are aided by computerised methodological advancements. Grill and

Tučková (2017) described the usefulness of a simple procedure of detecting number of pronunciation errors in the language samples using an iPad application to pave way for appropriate diagnostic classification amongst Czech-speaking typically developing children and children with SLI. Further, 'First access' method using the Specific Language Impairments tool (SLIt) for iPad, followed by acoustical analysis procedures was used to carry out similar classification of children with SLI based on the number of pronunciation errors (Grill, 2019). The results of the study showed success rate of greater than 93% in identifying and classifying children with SLI from typically developing children and other developmental language disorders (Grill, 2019).

2.3 Linguistic Characteristics of SLI

2.3.1 Phonological characteristics

The exhaustive literature on phonological acquisition and development observed in typically developing children has documented the systematic occurrence of 'phonological processes' throughout the developmental years which fade away in a specific time frame in order for the child to achieve adult-like phonological processing and production (Eg: Claessen et al., 2013; Dodd et al., 2013; Sutomo, 2012; Swingley, 2017). The persistence of phonological processes beyond the developmental years, indicates the possibility of an underlying phonological disorder. It is reported that children with SLI have continuing phonological processes beyond the linguistic refining time interval and show characteristic deficits in phonological perception, processing of phonemes, phonological acquisition and phoneme productions (Bishop et al., 2004; Claessen et al., 2013; Loucas et al., 2016; McArthur & Castles, 2013; Maillart et al., 2004; Ramus et al., 2013; Rispens & Been, 2007).

Research evidences have shown that children with SLI not only have phonological processes that last longer than usual, but also have atypical patterns of processes during their phonological acquisition period (Bortolini & Leonard, 2000). Further, the frequency of atypical patterns of phonological processes were higher for children with SLI in relation to typically developing peers (Leonard, 1998). A study done to compare the phonological characteristics of English-speaking and Italian-speaking children with SLI and typically developing peers, showed that the SLI participants had more difficulty in consonants and phoneme combinations that serve as means to express important grammatical markers in both languages. These difficulties were revealed in terms of specific unusual patterns of phonological processes including weak syllable deletions, final consonant deletions, initial syllable omissions, and cluster reduction and assimilations (Bortolini & Leonard, 2000).

Children with SLI are often reported to have deficits in phonological processing skills. Claessen et al. (2013) found that children with SLI performed poorer than the peer group on a battery for phonological processing tasks that assessed on measures of phonological representations, phonological awareness, rapid automatized naming, and phonological memory. Further, research shows that the phonological processing deficits vary amongst the SLI subtypes. Children with a subtype of SLI with reading decoding impairments had more significant difficulties in non-word repetition and phonological awareness (Loucas et al., 2016). In addition, findings from event-related potential responses comparing the neural responses for processing phonological details needed for coarticulation reported poorer responses for pre lexical-phonological stages but not lexical stages of processing in children with SLI (Archibald & Joanisse; 2012).

2.3.2 Morpho-syntactic characteristics

Children with SLI have marked deficits in morpho-syntax. The SLI population either take a longer time to acquire the comprehension and expression of the grammatical inflections or they may not acquire or become proficient in using the morpho-syntactic markers even in adulthood if intervention for the same is not provided (Leonard, 1998; Moscati et al., 2020). Some of the commonly affected grammatical categories include irregular plural morphemes, allomorphic variations, possessive morphemes, auxillaries, copulas, and tense inflections (Bishop & Norbury, 2002; Leonard, 1998).

The deficits that characterise the language of children with SLI or any other developmental language disorder varies based on the linguistic background of the individual who is tested. Kannada is considered as an agglutinative language that is morpho-syntactically complex and therefore, the linguistic deficits seen in Kannada-speaking and English-speaking children with SLI are different (Tiwari et al., 2017). A study investigated fifteen Kannada-speaking children with SLI, children without SLI and English-speaking children with SLI and reported that, although there were some shared characteristic deficits in non-word repetition and phonological processing, distinct patterns of morpho-syntactic deficits were evident across the three groups (Tiwari et al., 2017). Prasitha and Prema (2021) studied five typically developing children and five children with SLI to throw light on the morpho-syntactic acquisition in both groups of participants. All participants were assessed using 'Computerized Linguistic Protocol for screening' (Anitha, 2003) and Leonard's criteria, followed by elicitation of speech samples from each participant through picture description tasks, mother-child interactions and structured play. The results of the study showed that there

was reduced match in morpho-syntactic acquisition between the typically developing and SLI groups. The grammatical categories that showed maximum mismatches in SLI group were case markers, PNG markers and tenses. The development of grammar was characterised by irregularities, lack of order and high degrees of randomness in children with SLI. That further explains the increased frequency of usage of simple sentence forms, telegraphic speech and reduced utterance length in this clinical group (Prasitha & Prema, 2021).

A stronger association is found between the discourse deficits and morpho-syntactic difficulties. Evans (1996) used a performance-based model to find the impact of demands placed by the level of discourse on the morpho-syntactic deficits in individuals with SLI. Children with good receptive abilities had increased morpho-syntactic deficits as the discourse demands increased, however, the syntactic and morphological variables were independent of the discourse demands in children whose receptive and expressive language abilities were affected equally (Evans, 1996).

2.3.3 Pragmatic characteristics

It was often stated that when compared to other developmental language disorders such as Autism or Attention Deficit Hyperactivity Disorder, children with SLI do not have pragmatic deficits that are of the same severity as that of morpho-syntactic, semantic, metalinguistic or phonological deficits (Bishop, 2000; Katsos et al., 2011). It was reported that there was no significant underlying shared phenotypic and genotypic characteristics between the SLI group and Autism group of participants and therefore, the pragmatic difficulties seen in children with SLI could be due to the purported similitude of the linguistic disorders (Whitehouse et al., 2010). This was done by

studying the parents of participants and it was found that parents of children with SLI performed better in terms of pragmatic aspects when compared to parents of children with Autism (Whitehouse et al., 2010). However, competing research has shown that children with SLI also have significant challenges in the pragmatic domain, to an extent where the characteristics can manifest similar to PDD-NOS (Rapin, 1996).

The interpretation of pragmatic deficits seen in children in SLI can be done in two folds: Firstly, the pragmatic difficulties could be secondary to deficits in other linguistics components (i.e. morphology, semantics, syntax and phonology). Secondly, pragmatic deficits could be manifested primarily like other linguistic deficits in the SLI population (Bishop, 2000). Irrespective of the manifestation, children with SLI need to be assessed and intervened for socio-pragmatic problems over the course of the therapeutic intervention (Narayanan et al., 2021).

Osman et al. (2011) studied the pragmatic difficulties in sixty children with SLI and children without SLI using the 'Pragmatic Screening protocol' and a significantly poorer performance in non-verbal paralinguistic skills like greetings and maintaining attention throughout social conversation was found in children with SLI. The SLI group also had Total Pragmatic Score lesser than the cut-off indicating considerable pragmatic difficulties (Osman et al., 2011). A systematic review on pragmatic difficulties in children with SLI reported deficits in taking turns in a social context, maintaining a topic of conversation, inappropriate content, and lack comprehension of social contexts. The study also highlights that the manifestation of pragmatic deficits is not commensurate within the SLI population, thereby, affecting the language

disproportionately and supporting the subtyping of the SLI based on the phenotypic clinical presentations (Narayanan et al., 2021).

2.3.4 Semantic characteristics

The semantic difficulties in children with SLI can be understood by the wide range of lexical deficits and deficits in other related linguistic factors exhibited by this clinical population (Lahey & Edwards, 1996). The semantic characteristics include poor lexical comprehension, difficulty in learning new words, reduced vocabulary, restricted lexical diversity, lack of variety in word class, poor use functional words, contextually inappropriate word usage and poor naming skills (Eg: Alt et al., 2004; Alt & Plante, 2006; Bishop et al., 1996; Lahey & Edwards, 1996; Marinelle & Johnson, 2002; Rapin & Allen, 1983). The possible explanations to these difficulties in semantics are attributed to auditory processing difficulties (Tallal et al., 1996), phonological working memory deficits (Edwards & Lahey, 1998; Montogomery, 1995; Montogomery et al., 2016), or individualistic lexical diversity based on linguistic experience and other personal or environmental factors (Mainela-Arnold et al., 2010).

The results of a study comparing lexical-semantic abilities in children with SLI and their typical peers revealed that children with SLI performed poorer in a word definition task and their responses had missing content that was required to define the target word (Mainela-Arnold et al., 2010). This result was true irrespective of the phonological neighbourhood density. The authors also suggested that lexical competition is a predictor for semantic skills in children with SLI (Mainela-Arnold et al., 2010). Another study on similar lines reported poorer performance in word

definitional skills of children with SLI in terms of the content as well as form (Marinellie & Johnson, 2002).

An item-by-item analysis done between fourteen children with SLI versus chronological age matched participants and expressive vocabulary level matched participants showed that children with SLI produced significantly increased number of lexical- semantic errors compared to both groups of typical children (Sheng & McGregor, 2010). Alt and Plante (2006) used a mixed design to compare across and within the groups of participants with SLI, participants matched based on the mean length of utterance and participants matched on the basis of chronological age. This study focused on examining the lexical-semantic fast mapping abilities using only visual information, visual with non-linguistic auditory information and visual with linguistic auditory information and found SLI children performed poorer than the two control groups, thereby, supporting the "Limited capacity model of processing" in children with SLI (Alt & Plante, 2006). This information was confirmed by the poorer performance of children with SLI in the picture naming and story retelling tasks, as this showed the increased use of 'general-all-purpose' verbs and limited range of vocabulary used to do the assigned linguistic task (Kambanaros & Grohmann, 2015).

A significant effort has been offered to the understanding about intervention of children with SLI using a variety of learning and language stimulation techniques. The reduced improvement in semantic aspects after linguistic training is also shown by some studies, highlighting the persisting deficits in word learning and vocabulary density (Gray et al., 2012; Kan & Windsor, 2010; Storkel, 2004). Children with SLI have low 'unfamiliar object production advantage' that continued over time, restricting

the child from learning new words even after the sustained exposure of the target word (Gray et al., 2012).

The present day understanding about semantic abilities and deficits in children with SLI is that the semantic domain is heterogeneous in nature. The semantic development and lexical semantic skills could fall at any point on the spectrum whose one extreme is where the skills in SLI are comparable to the typically developing children and the other extreme is where there are significant difficulties in semantic processing and production in children with SLI (Hick et al., 2002; Leonard, 1998; Mcgregor et al., 2002; Rice et al., 1994). Therefore, careful profiling of the linguistic deficits is often recommended to the clinicians working with children with SLI to foster significant amelioration in the speech and language skills with the help of therapeutic intervention.

2.4 Bilingualism and multilingualism in SLI

Language acquisition and development is extensively studied in the monolingual condition, however, the context where the child is exposed to two or more languages is naturally more complex as there are numerous influencing factors to consider (Rothweiler, 2007). It was believed that bilingualism and multilingualism in a clinical population such as SLI, would hinder the development of language because of the competing effect causing confusion while learning language. However, studies have shown contradictory results stating that multilingual environment could provide richer linguistic input to the child and facilitate better communication (Goldstein, 2012; Roeper, 2012; Rothweiler, 2007).

It is important to consider bilingualism and multilingualism in the Indian society as it has marked diversity in linguistic and cultural aspects (Pattanayak, 1990; Pattanayak, 2008). Most of the children belonging to the Indian population are raised in a bi/multilingual environment. Syntax and semantics are the two important components of language that undergo significant changes due to the linguistic differences across given languages. In the context of bilingualism in children with SLI, the major focus is on morpho-syntactic deficits like sentence fragmentation, conjunction omission, preposition omission and errors in case markers (Armon-Lotem, 2011; Meir & Armon-Lotem, 2017).

With respect to semantics, the concept of code-mixing and code-switching between two languages is also taking the spotlight. In a recent pilot study, a comparison was done between the simultaneous bilingual SLI and bilingual typically developing children by controlling the environmental variables such as age of first exposure, duration of exposure and the context of exposure of the languages. The outcome of the study suggests that irrespective of being monolingual or bilingual, children with SLI had poorer phonological short-term memory, inappropriate lexical selection, irregular grammatical inflections, and poor narrative abilities (Marini et al., 2019). A multilingual child with SLI with exposure to Bulgarian, English and Greek was studied and compared to typically developing multilingual children (matched for both chronological age and language) and monolingual children with SLI using a picture naming task (Kambanaros et al., 2015). The outcome was that the lexical storage and retrieval deficits were similar across the three languages in the participant of this study indicating marked difficulty in semantic aspects independent of the languages (Kambanaros et al., 2015). Gutierrez-Clellen et al. (2009) studied code-switching by

using the narratives and conversational samples of Spanish-English speaking children with SLI and children who did not have a language impairment and the results showed that children with SLI can code-switch without displaying an abnormal pattern. The positive results of code-switching by using the linguistic elements of dominant language into the non-dominant language could be interpreted as a compensatory strategy to overcome the limited linguistic abilities on one hand, and on the other, code-switching could genuinely be claimed to be less affected in children with SLI (Gutierrez-Clellen et al., 2009).

Kapantzoglu et al. (2021) found that code-switching was similar between children with SLI and typically developing children and hence it could not serve a good indicator to distinguish between language disordered population and developmental typical population. On the other hand, language control, code-switching and code-mixing was examined by subjecting fifteen Spanish-English bilingual children with Developmental Language Disorder and typically developing children to perform a scripted dialogue task. It was identified that children with SLI replied in English when questioned in Spanish or vice-versa and hence demonstrated higher levels of cross-talker code-switching. However, the extent of code-mixing was identical for both the group of participants (Gross & Kaushanskaya, 2022).

Therefore, the understanding about the nature of code-mixing, code-switching, sophisticated use of dominant or non-dominant language and other factors related to bilingualism /multilingualism in children with language disorder, specifically SLI, is controversial and lacks consensus (Gross & Kaushanskaya, 2022). There is a dearth of

literature that throws light on the linguistic changes that occur in the context of multilingualism in language impaired population.

2.5 Assessment of SLI

A thorough assessment of children with SLI and other developmental language disorders starts with case history. It helps in understanding crucial information including family history and identification of significant precipitating and maintaining risk factors that may hamper the positive effects of intervention (Rudolph, 2017). Other important areas of assessment would include parent child interaction, speech-language assessment and reading-writing examination (Bortolini et al., 2002; Losardo & Notari-Syverson, 2001). Appraisal procedures that would be carried in order to diagnose SLI based on the exclusionary principle are audiological evaluation, neurological evaluation, socio-emotional assessment, cognitive-psychological assessment and motor examination (Eg: Conti-Ramsden et al., 2013).

Following the case history and other preliminary, yet, significant part of assessment procedure, the language assessment becomes the major focus. The assessment of language could be done using a variety of approaches which are discussed in the sub-sections below.

2.6.1 Standardised assessments

Children with SLI exhibit a wide range of clinical characteristics which makes the assessment of all the linguistic domains significant to get a thorough understanding about their current language levels and intervention needs. The number of standardised test materials used in the assessment of children with language impairment is profuse

(Betz et al., 2013). The choice of the test materials may depend on a number of factors like frequency of use in the clinic and psychometric properties of the test (Betz et al., 2013; Denman et al., 2023). Recent investigations have found that clinicians prefer omnibus language tests for the initial assessments whereas semantic or vocabulary tests are more often preferred for follow-up assessments (Denman et al., 2023; Ogiela & Montzka, 2021).

There are some important features that distinguish the standardized assessment procedure with other approaches to assessment in children with language impairment. Firstly, standardised procedures are critically analysed and systematically put forth to ensure the uniformity in its administration across clinicians, places and time. Secondly, the content, administration, scoring, test items and interpretation is standardised, thereby fixing the directions in using the test materials. Thirdly, the test needs to be administered on a multitude of target population for several trials to standardize it. The differences in the interpretations make the tests either norm-referenced or criterion-referenced (Betz et al., 2013; Denman et al., 2023).

Some commonly used standardized test materials to assess language across the globe include Clinical Evaluation of Language Fundamentals (CELF-5)(Wiig et al., 2013), Grammar and Phonology Screening (GAPS) test (Gardner et al., 2006), Northwestern Syntax Screening Test (NSST-Short form) (Ratusnik et al., 1980), Peabody Picture Vocabulary Test (PPVT-4) (Dunn & Dunn, 2007) and Test of Language Development-Primary (TOLD –P4) (Newcomer & Hammill, 2008). Some of the commonly used Indian tests are Assessment of Language Development (ALD)

(Lakkanna et al., 2021), Assessment Checklist of Speech and Language Skills (ACSLS) (Swapna et al., 2010) and Linguistic Profile Test (LPT) (Suchithra & Karanth, 2007).

2.6.2 Dynamic assessment

Due to the increasing demands on working with culturally and linguistically diverse population, there is a need of delineating the differences between 'Language Difference' and 'Language Disability' (Moore-Brown et al., 2006). The most accurate way to study this is by using dynamic assessment that follow the 'test-teach-retest' procedures in an ongoing cyclical pattern. Moore-Brown et al. (2006) report that the notable amelioration in the performance of the child within a small period of linguistic support or scaffolding indicates 'Language Difference', and if there are persisting difficulties in language, in-spite of teaching language, throws light on the underlying 'Language Disability'. A pilot study on children with SLI that assessed the intervention outcomes with the dynamic assessment framework using the CELF test material, highlighted the effective depiction of linguistic measures before and after a mediated language training phase (Hasson & Botting, 2010).

2.6.3 Language sampling

Language sampling is an assessment procedure which focuses on understanding the expressive speech and language productions of the individual in a natural environment (Calder et al., 2017; Klatte et al., 2021; Price et al., 2010; Westby, 2021). The language sampling procedure includes some critical steps. Firstly, the clinician is required to record the individual while speaking spontaneously to narrate, describe or converse in a natural real-life context. Language samples could also be collected during a play session or parent child conversations (Evans & Craig, 1992). Secondly, the

clinician should use this recording to either perform a narrow or broad transcription of the collected sample depending on the need of the clinician (Manning et al., 2020; Westby, 2021). Thirdly, the target linguistic parameters (Eg: vocabulary, number of different words, mean length of utterances, C-units, and grammatical markers) are obtained by subjecting the transcription to analysis, manual or computer-based, based on the goals of the assessment. Lastly, a detailed profiling of the language abilities of the assessed individual is prepared based on the results of the analysis. The profiling contributes to framing meaningful, comprehensive and individualistic goals for language intervention (Westby, 2021).

Language sampling could also benefit the clinician to study the parental interaction with the child by obtaining samples that throw light on use of language intervention strategies by the parents (Eg: manner of using of modelling, frequency of using the strategy, and use of augmentative strategies along with modelling), type of parent-child interaction (Eg: Directive, non-directive, interactive, and manipulative) and extent of involvement of the parents in the conversation with the child (Eg: Readiness and responsiveness in the conversation, number of dialogues, number of interrogatives, maintenance and engagement in the topic, and taking turns with the child) (Bullard et al., 2017; Tamis-LeMonda et al., 2001).

There is a profusion of advantages to using language sampling over other assessment procedures. Standardised test procedures are biased as they are norm-referenced, that is, the performance of an individual is compared against a group of typically developing children. This becomes a dilemmatic situation when that particular individual who is being assessed and the individuals involved in norm-referencing

belong to different cultural and linguistic backgrounds. Use of language sampling procedure could help with overcoming limitation of overestimation or underestimation of an individual's language profiles caused by standardised assessment procedures that leads to cultural and linguistic biases (Newkirk-Turner et al., 2016; Westby, 2021). Another important aspect to consider is that language sampling helps in obtaining the expressive language in a natural context which eliminates the bias that could occur due to a non-natural structured clinical set-up (Finestack et al., 2014; Larson et al., 2020). Also, the possible number of linguistic measures that could be obtained using language sampling is multitudinous (Finestack et al., 2014). An additional advantage to language sampling is that it paves way to assess more sophisticated linguistic outcomes like code-switching and inter-sentential language shift. On the contrary, the standardized test materials offer limited language outcome measures and it is most often measured in one language at a given point in time.

In the recent years, there have been attempts made to study the feasibility of adopting language sampling approach to tele-practice in the field of speech-language pathology. During the challenging time of COVID 19 pandemic, the feasibility, reliability and validity of language sampling was explored using 46 dyads of participants and it was found that online analysis did not differ significantly from the in-person collection and analysis of language samples (Manning et al., 2020). There are numerous beneficious outcomes from the use of language sampling analysis and hence, it should be included in the routine clinical assessments of children with language impairments.

2.6.4 Other assessment procedures

Apart from the approaches mentioned in the previous subsections, other appraisals are seldom used, especially in the Indian context. Some of them are curriculum-based assessment, ethnographic interviewing, parent/teacher interview and systematic observation.

Curriculum-based assessment is usually done for school-going children with SLI. This type of assessment is usually done by special educators, teachers or speech-language pathologists who provide services in school setups. Curriculum-based assessment is often described as a type of assessment that periodically measures language skills based on the academic demands of the individual (Parsons et al., 2005). Most often, this approach follows the "RIOT" Model (Review, interview, observe and test) (Hosp, 2008) in one way or another.

Ethnographic interviewing is based on the concept that people belonging to different cultural backgrounds would have differences in their beliefs and thoughts. Therefore, asking uniform, pre-determined, structured, and clinician-centred questions in an interview with the caregivers leads to results that could be highly biased in terms of cultural and linguistic diversity (Briggs, 1986; Westby, 1990). Ethnographic interviewing involves a non-judgemental, culturally and linguistically sensitive, and patient-centred approach to interview (Spradley, 1985; Westby, 1989). It enables the clinician to build strong professional rapport and elicit meaningful information about the child's language difficulties from the caregivers through the use of open-ended questions, dichotomous questions, presuppositional questions, prefatory statements, experience questions, native-language questions, direct language questions and

hypothetical interaction questions (Westby, 1990). The descriptive responses that are obtained from the caregivers help the clinician understand what is important to the caregivers and how to incorporate it into the assessment and intervention procedures (Briggs, 1986; Patton, 1980; Spector, 1985; Spradley, 1979; Westby, 1989).

Information gathered through parent/teacher interviews is also considered significant in planning for assessments, interventions and developing Individual Education Plan (IEP) (Bishop & McDonald, 2009). Children spend the majority of their time with caregivers, parents or teachers and hence, they provide factual information (such as medical history, family history, and demographic data), and information about specific cultural beliefs and behaviours (Westby, 1990). The interview procedure could be structured or unstructured, clinician-centred or client-centred, formal or informal. Some clinicians prefer to use self-administered parental questionnaires [Eg: Parental Linguistic Concern Questions (PLCQ) (Auza et al., 2023)]. Thus, information from the interview with parents/teachers contributes significantly in the entire course of assessment and intervention.

Lastly, systematic observation done by the clinician could be of tremendous benefit because the examiner can get information about the child's current communication patterns. Observations by the examiner could be done in different methods (Eg: Participatory or non-participatory) during play sessions, conversations, or storytelling and it helps the examiner to gain information about the child's play skills, language abilities, and communicative gestures (Ostsuka & Jay, 2017; Portell et al., 2015).

Depending upon the situational needs of the child, and the associated caregiver and examiner-related factors, the clinician can adopt a combination of assessment procedures to elicit the maximum amount of meaningful information about the child's language difficulties to comprehend the intervention requirements.

2.7 Linguistic measures obtained using language sampling

The measures obtained through the use of language sampling are innumerable in the present era of research. There are several indices and metrics which could be obtained for each language component.

Some measures to get insight into the morpho-syntactic abilities of an individual includes Mean Length of Utterance (MLU), Mean Length of Longest Utterance (MLLU), clause boundaries, context-dependent morphological disambiguation, morpho-syntactic mapping, subject-verb agreement, tense markers, augmented speech comprehensibility index, case markers, and word order (Eg: Binger et al., 2016; Cole et al., 1989; Dowden, 1997; Eisenberg, 2001; Smeaton & Sheridan, 1991).

Phonological aspects could be assessed by measuring the phonological processes (like epenthesis, deletions, spoonerisms, and devoicing), Phonological Mean Length of Utterance (PMLU), Proportion of Whole word Proximity (PWP), Percentage of Consonants Correct (PCC), Percentage of Vowels Correct (PVC), Relative Distortion Index (RDI), Process Density Index (PDI) and Articulatory Competence Index (ACI) (Eg: Bunta et al., 2009; Ingram & Ingram, 2001; MacLeod, 2011; Shriberg & Kwiatkowski, 1982).

Likewise, pragmatic abilities could be assessed by considering some measures of discourse such as C-units, coherence, cohesion, proficiency, type of discourse (Eg: Expository, instructional, and narrative), exchange structure analysis, subordination index, clausal density and politeness markers (Eg: Nippold et al., 2014; Miller et al., 2016; Spencer et al., 2023; Togher, 2001; Westerveld & Clasessen, 2014).

Using a combination of the required measures could help clinicians obtain rich data about the language abilities for individualised assessment and intervention procedures, thereby fostering efficient clinical decisions and intervention practices that are culturally and linguistically justified.

2.8 Lexical Diversity measures obtained using language sampling

Measuring Lexical Diversity is a sophisticated way of understanding the underlying lexical-semantic richness, width of the vocabulary, and variance in lexicon in a particular individual (Fergadiotis & Wright, 2011). It throws light on the speakers' ability to store, retrieve, access, learn and relearn target words and use these semantic units to frame larger units of language such as discourse and narration (Fergadiotis & Wright, 2011; Fergadiotis et al., 2013; Thordardottir & Namazi, 2007).

Some important measures related to the lexical-semantic abilities of a given individual include the Number of different words (NDW), Total number of words (NTW), Type Token Ratio (TTR), Moving Average of Type Token Ratio (MATTR), Vocabulary Density (VocD), Maas Index, Measure of Textual Lexical Diversity (MTLD), D index, and Hypergeometric distribution (Eg: Fergadiotis & Wright, 2011; McCarthy & Jarvis, 2007; McKee et al., 2000; Moses et al., 2020; Yang et al., 2022).

Some of these measures are obtained manually by counting the desired measures from the language transcripts, while others involve more complex and intricate mathematical formulae to get the target measure.

Numerous factors affect the outcome of the lexical diversity measures. Apart from the obvious influential linguistic factors, some non-linguistic factors that have shown to affect the lexical diversity analysis includes length of the sample elicited (Stills, 2016; Yang et al., 2022), number of prompts used to elicit responses, number of probe questions used, and preference of the stimuli (Yang et al., 2022). Literature suggests that several lexical diversity measures are affected specifically due to the length of the sample. A study done by Stills (2016) revealed that length of the sample had a significant effect on the TTR. Maas scores and MTLD scores were affected by length but had a smaller effect size when compared to the TTR measures. TTR is considered to be the least sensitive to identify children with language impairments because it gets influenced by the sample size, hence it is misleading (Ratner et al., 2024; Stills, 2016). On the other hand, use of other measures like MATTR and VocD is proved to be better alternatives (Ratner et al., 2024). The frequent use and adaption of the alternative lexical diversity measures is hindered because of the reliance on the computerized algorithms to obtain these measures (Ratner et al., 2024). Therefore, it is recommended to use the measures that are scientifically more appropriate and controlled to avoid the undesired effect of other factors on the obtained sample analysis.

Measuring the lexical semantic measures have been done as a part of micro-structure content analysis (Yang et al., 2022), stylometric analysis (Holmes & Singh, 1996), macro-structure language analysis (Gordon, 2008), and semi-spontaneous

language analysis (Lind et al., 2009) in an array of clinical populations. All of these procedures make use of different indices and measures of lexical semantics to give an objective and quantitative outcome that could be used as part of assessment and intervention for individuals with communication difficulties.

2.9 Computerized Language Sampling Analysis (CLSA): Use of Systematic Analysis of Language Transcripts (SALT) software

Some of the lexical diversity measures can be obtained by simple manual calculations, while others are obtained through complex mathematical operations. A number of studies show that using simple measures like NDW or TTR causes the outcomes to be more skewed towards less appropriate diagnostic direction for a given individual (Ratner et al., 2024; Yang et al., 2022). The alternative measures are far more complex and time-consuming if they are calculated manually (Liu et al., 2023; Pezold et al., 2022). The availability of Computerized Language Sampling Analysis (CLSA) therefore helps ameliorate clinical decision making and obtaining functional outcomes. Many clinicians feel the need for the CLSA methods because they lack the luxury of time and resources (Garbarino et al., 2020; Pezold et al., 2022 Pavelko & Owens, 2017). This eases the study of language sampling by providing the clinicians with a multitude of linguistic measures, ratios and indices through the use of various software packages.

Several dedicated software programs are used to study the language samples using the CLSA methods. Systematic Analysis of Language transcripts (SALT) (Miller & Chapman, 2009; Miller & Iglesias, 2012), Sampling Utterances and Grammatical Analysis-Revised (SUGAR) (Pavelko et al., 2022), and Programs to Examine Phonetic and Phonologic Evaluation Records (PEPPER) (Weston et al., 1989) are some software

programs that enable the clinicians to get myriad of measures of expressive language in a brief period of time (Arabpour et al., 2023; Calder et al., 2017).

SALT is a robustly used paid software for CLSA as it can be used to analyse language samples obtained from individuals belonging to any age group or clinical population (i. e. Early childhood, preschool age, school age, adulthood or old age) (Arabpour et al., 2023). The sample types and contexts that can be elicited and analysed using SALT are multitudinous including play conversations, narratives, expository, dialogues or persuasions (Millers & Chapman, 2009). It has a built-in comparative database mainly for two to eighteen years old English speakers. However, it is beneficial for analysis involving individuals who speak other languages by using suitable coding procedures (Miller & Iglesias, 2012; Pezold et al., 2020).

The main quantitative measures that can be obtained using SALT include 'Total utterances', 'Intelligibility Measures' (% Intelligible Utterances and % Intelligible Words), 'Syntax/Morphology' (MLU in words, MLU in morphemes and Verbs/utterance), 'Semantics' (NDW, NTW, TTR and MATTR), and 'Discourse' (% Responses to Questions, Mean Turn Length, Utterances with Overlapping Speech and Interrupted Other Speaker). SALT enables the clinician to get information about other aspects like 'Verbal Facility' which throws light on the fluency estimates such as words/minute, pauses within utterances, pauses between utterances, pause time as percentage of total time and abandoned utterances. It also calculates the percentage of errors, number of omissions and number of error codes.

To summarize, there are several shortcomings in a procedure that uses only standardized tests for assessing a child's language skills. The caveats of using standardized tests include restriction to a fixed number of words, fixed set of questions, being limited to one language at a time and reduced flexibility in the assessment protocol. This leads to a culturally and linguistically less sensitive way of assessing a given individual. The use of software programs for language sampling has garnered considerable attention in the recent years and has promising outcomes to address the shortcomings of standardized assessments.

The combination of language sampling analysis done manually or using computerized versions along with the results of standardized assessments and parental interview will help in creating a detailed, meaningful and structured communicative profile for a given individual. Hence, possible incorporation of the above mentioned assessment procedures, measures and analysis is recommended for achieving a holistic outcome. Studies exploring on this dimension of language assessment are scarce in the Indian context, indicating a pressing need to improvise research in this area. Therefore, this study focuses on using computerized language sampling analysis to obtain lexical diversity measures in children with SLI.

CHAPTER 3

METHODS

The study aimed to compare the lexical diversity measures in children with SLI and typically developing children matched on the basis of chronological age and expressive language age. The two main objectives of the study were (a) To compare lexical diversity measures of Number of Total words (NTW), Number of Different words (NDW) and Moving Average of Type-Token Ratio (MATTR) in chronological age matched typically developing children and children with SLI and (b) To compare lexical diversity measures of Number of Total words (NTW), Number of Different words (NDW) and Moving Average of Type-Token Ratio (MATTR) in expressive language age matched typically developing children and children with SLI.

3.1 Participants

A total of 30 participants (7 girls, 23 boys) were included in the study and classified into three groups. Ten children with SLI in the age range of four to eight years (1 girl, 9 boys; mean age: 5.58 years) formed the clinical group. Chronological age matched (2 girls, 8 boys; mean age: 5.57 years) and expressive language age matched (4 girls, 6 boys; mean age: 3.78 years) typically developing children were the participants of control group 1 and control group 2 respectively, with ten participants in each group.

3.1.1 Criteria for selection of participants

- The participants of the study, irrespective of the group belonged to a native Kannada speaking family residing in and around Mysore.

- All participants belonged to families of middle socio-economic status as assessed using the revised NIMH Socio Economic Status Scale (Venkatesan, 2011).
- All participants in the clinical group had a clinical diagnosis of SLI based on assessments by a qualified SLP and a clinical psychologist. Participants who fulfilled the SLI criteria given by Leonard (1998) were part of the study.
- The participants of the control groups had no history of prenatal, perinatal and postnatal abnormalities. The International Classification of Functioning, Disability and Health: Child and Youth version checklist (WHO, 2007) was used to rule out any developmental impairment in participants of these groups.

3.2 Research design

A standard group comparison design was carried out in the study to investigate the differences in the lexical diversity measures in children diagnosed with SLI and typically developing children matched in terms of chronological age and expressive language age.

3.3 Informed Consent and Ethical Clearance

The study followed the ethical guidelines prescribed by the ethical committee for bio-behavioural research involving human subjects at the All India Institute of Speech and Hearing (Venkatesan, 2009). The caregivers of the participants were explained about the purpose, aims, and procedure of the study. Following the explanation, an informed written consent was taken from the primary caregivers.

3.4 Tools and Test materials

- ***Assessment of Language Development (ALD):*** The receptive and expressive language age was estimated using the ALD test material (Lakkanna et al., 2021). ALD is a tool that enables the clinician to obtain information about the comprehension and expression abilities of participants ranging from birth to ten years. It has two sections to assess language: the receptive language and expressive language, respectively. The test helps us to assess the language age using a combination of information based on parent interview and direct assessment of the participant using certain tasks.
- ***Picture stimuli:*** A picture description task was carried out using picture stimuli that depicted a "park" scenario (Diddee, 2013) (Refer to Appendix). The verbal utterances were evoked using this picture stimulus along with some probe questions that are discussed in the following sections.
- ***Systematic Analysis of Language Transcripts (SALT):*** The audio-recorded language samples were manually transcribed and subjected to the analysis by the software. The SALT software was used to calculate the dependent variables (NTW, NDW and MATTR) for each participant of the study.

3.5 Test environment

All the participants of the study were individually tested in a quiet environment with adequate amount of illumination and ventilation. The room was kept free of any sort of distractions such as other non-related toys, bright lights, noises, or wall paintings. During the time of evaluation and language sampling, the participants were exposed to the required test materials only.

3.6 Procedure

The procedure for the study was carried out in three phases.

Phase 1

Firstly, an informed written consent was taken from the caregiver after an elaborate explanation about the study. The Phase 1 included the collection of general information and demographics details of each participant. Assessment of Language Development (ALD) was administered on each participant, irrespective of the group they belonged, in order to obtain the receptive and expressive language age of the participants. This procedure was done to match the expressive language age of the children with SLI and typical children who would constitute control group 2. The caregivers of all participants were subjected to the administration of NIMH Socio Economic Status Scale (Venkatesan, 2011) to confirm that the participants belonged to middle socio-economic status. Caregivers of participants belonging to control groups 1 and 2 were asked to answer the International Classification of Functioning, Disability and Health: Child and Youth version checklist (WHO, 2007) to rule out the possible existence of any other developmentally atypical characteristics.

Phase 2

In Phase 2 of the study, the investigator carried out a picture description task using the picture stimulus (Diddee, 2013) for all the participants. This picture stimulus is expected to evoke different word classes such as commonly used names of lexical items, common action words, pre/postpositions, connecting words, adjectives. The instruction given to the participants was *"Look at this picture and describe what is happening in the picture*" (/iː tʃĩt̪rɑʋanːuː noːɖi iɖːaralːi jeːneːn aːgt̪aː iɖe ant̪a heːɭu/) A

minimum of fifty utterances was expected to be evoked from each participant. If the participant did not produce at least fifty utterances spontaneously, a set of six fixed questions were posed by the investigator in order to evoke the required sample as and when needed. These questions included "*What do you see in the picture?", "What is this person doing?"*(By pointing at a person from the picture whom the child has not talked about)*, "Why do you think they are doing that?*"(By pointing to people whom the child has seen but has not talked about the actions that they are doing), *"Did you see this?"* (By pointing at something that the child did not talk about) and *"What more do you see?".* The language sample was recorded using an inbuilt microphone in an android device. The recorded sample was transcribed and the transcription was further subjected to analysis using the Systematic Analysis of Language Transcripts (SALT) software (Research version 18.3.13) to obtain measures of lexical diversity.

Phase 3

Performing the reliability measures, data analyses, quantitative and qualitative statistical analysis constituted phase 3 of the study. Prior to the data analysis, inter-judge reliability for transcription and analysis on the SALT software was estimated by giving 20% of data to a qualified Kannada-speaking Speech- Language Pathologist well-versed with transcription and the usage of SALT software. Cronbach's Alpha was carried out to document the inter-judge reliability.

3.7 Data analysis

The transcription of the audio-recorded language samples of all the participants of the study was uploaded to the SALT software for data analysis. The three measures of lexical diversity taken into consideration for this study were as follows:

- Number of total words (NTW): It is the total count of all the words present in the transcription.
- Number of different words (NDW): It is derived from the productions of unique free morphemes and hence, considered as the direct index of lexical diversity. NDW is the number of unique words calculated only from the main body of the transcripts excluding utterances that fall under the category of "mazes". (With respect to the SALT software, "mazes" include false starts, revisions, repetitions, fillers and pauses).
- Moving average Type-Token Ratio (MATTR): MATTR uses a moving window to estimate the TTR. Initially a window length is selected, for example, 20 words. The TTR is calculated for 1 to 20 words firstly, then the TTR is calculated for 2 to 21 words, then 3 to 22 words and so on till the end of the transcript. The TTRs obtained for each window is then averaged to obtain the MATTR which is less dependent on the length of the utterance. The algorithm for computation of MATTR works on the basis of hash coding in a hash table data structure by Microsoft Net with an implementation of C# computer program (Covington & McFall, 2010). The first step in the algorithm would be to identify the words in the sample after a window size is fixed, following that, a complete frequency of occurrence of these words in a given window are computed. A hash table consisting of value pairs (for MATTR calculation, the entries of 'word' and its 'frequency' becomes the value pairs) is prepared. This hash table stores the words and frequency of occurrences for that particular window which is being analysed. When there is a shift in the window, there is decrement of one word from left side of the window and increment of one word from right side. The frequency value of the added word will be increased by 1

count and a new hash table entry will be done if the added word is new word which was not present in the previous window. Similarly, the frequency value of the subtracted word will be decreased by 1 count if its entry already exists and hash table entry for the subtracted word is removed if it is not present in the new window considered for analysis (Covington & McFall, 2010).

In addition, the language samples were analysed qualitatively in terms of a number of semantic aspects. The qualitative analysis focussed on documenting the differences, if any, with respect to the following components:

- *Word class*: The language sample transcripts were inspected by the investigator in order to find the different word classes that were present in each individuals' sample. These word classes included nouns, verbs, adjectives, determiners, conjunctions, prepositions/postpositions, interrogatives, and interjections. The presence of the word classes was checked first. Following that, the average frequency of word classes that were predominantly used by the participants was documented for each participant of the study.
- *Code switching:* The picture description task was carried out in Kannada language with appropriate instructions (/iː tʃi̪ɾavanːuː noːɖi iɖːaralːi jeːneːn aːgt̪aː iɖe ant̪a heːl̪u/).The use of words from English in between a Kannada discourse indicated the presence of code switching and code mixing. In this study, code switching is operationally defined as shifting from Kannada to English between two utterances. If any of it was observed, it was documented. This was done by writing down the words and phrases that demonstrated code switching and then estimating the extent of it across each group by counting the frequency with which code-switching occurred in each language sample.

The overall average for the same was computed. Further, the frequency of code switching each word class was also compared between clinical and control groups.

- *Code mixing:* The shifting from Kannada to English within an utterance is considered as code mixing in this study. The procedure to analyse the extent of code mixing was the same as that mentioned for code switching.

3.8 Statistical analyses

IBM's SPSS for Windows (version 26) statistics software package was used for the statistical analysis of the measures obtained quantitatively. The descriptive and inferential statistical outcomes focused upon following the segregation of the data in a group-wise fashion. Mean and standard deviation was found as a part of descriptive statistical measures. Shapiro-Wilk's test of normality was done to verify the distribution of the data. As the data was found to be normally distributed, parametric tests were carried out for further analyses. One-way MANOVA was administered to compare the lexical diversity measures across the three groups of participants followed by Univariate analysis. Post-Hoc tests were done using the Tukey's Honestly Significant Difference for Multiple Comparisons to compare between the groups being studied.

CHAPTER 4

RESULTS

The study aimed to compare the lexical diversity measures of children with SLI (4 to 8 years) with that of chronological age matched and expressive language age matched typically developing peers. Quantitative and qualitative analyses were performed in order to compare across the groups for the lexical diversity measures considered in the present study, namely NTW, NDW and MATTR.

IBM's Statistical Package for Social Sciences (SPSS) for Windows (version 26) was used for the statistical analyses of the measures obtained quantitatively. Firstly, Shapiro-Wilk test of normality was done to verify the distribution of the data. The results of the Shapiro-Wilk test revealed that the data followed normal distribution ($p>0.05$) and hence, parametric tests were used for further analyses. The descriptive and inferential statistical outcomes focused on data segregation in a group-wise fashion. Means and standard deviations were computed for the lexical diversity measures in children with SLI (clinical group) and their typical peers (control groups 1 and 2) as a part of descriptive statistical measures. The results of the study are elucidated under four subsections which are as follows:

4.1 Inter-judge Reliability

4.2 Comparison of lexical diversity measures between clinical group and control groups

4.3 Comparison of mean frequency of different word classes used by clinical group and control groups

4.4 Comparison of mean frequency of code-switching and code-mixing in the clinical group and control groups

4.1 Inter-judge Reliability

The inter-judge reliability was checked for the data transcription and analysis of lexical diversity measures using SALT software. Another Kannada-speaking speech-language pathology post-graduate student who was well-versed in the language sampling procedure served as the second investigator and repeated the procedure for 20% of the data in each group of participants. The results of analyses obtained by the two investigators were compared using Cronbach's alpha. The results showed that the Cronbach's alpha coefficient was 0.99 indicating 'excellent reliability' (Konting et al., 2009) in the procedures done by the two investigators for NTW, NDW and MATTR. The results obtained using Cronbach's alpha were further verified by performing correlation analysis using Spearman correlation coefficients for each measure of lexical diversity. A strong correlation was obtained between the two investigators for all the three measures of lexical diversity considered in the study, that is, NTW ($r= 0.986$, $p<0.01$), NDW ($r= 0.928$, $p<0.01$), and MATTR ($r= 1.000$, $p<0.01$), thereby indicating good inter-judge reliability.

4.2 Comparison of lexical diversity measures between clinical group and control groups

The results in this section address the objectives 1 and 2 of the study. The means and standard deviations were computed for the NTW, NDW and MATTR measures of lexical diversity in each group of participants using descriptive statistics which are depicted in Table 4.1.

From Table 4.1, it can be observed that the mean values for the measures of NTW, NDW and MATTR were higher in control group 1 (chronological age matched typical children) compared to both clinical group (children with SLI) and control group 2 (expressive language age matched typical children). Further, control group 2 obtained higher mean values than the clinical group for the measure of NTW. However, the clinical group had higher mean values for NDW and MATTR measures compared to control group 2.

Table 4.1

Means and Standard Deviations (SD) of the scores on lexical diversity measures obtained by participants in the clinical and control groups

Participant group	**Clinical group (n=10)**		**Control group 1 (n=10)**		**Control group 2 (n=10)**	
Measures	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**
NTW	99.20	27.28	130.20	32.51	100.90	38.02
NDW	58.30	16.34	79.30	16.85	53.10	18.11
MATTR	0.61	0.08	0.66	0.07	0.55	0.49

Note: NTW=Number of Total Words; NDW= Number of Different Words; MATTR= Moving Average of Type Token Ratio.

To verify these findings statistically, the data was subjected to appropriate statistical tests. One-way Multivariate Analysis of Variance (MANOVA) was used to determine if there was a significant effect of the group on lexical diversity measures considered in the present study. Results of MANOVA revealed that there was a significant effect [$F (6, 50) = 2.724$, $\lambda = 0.568$, $p = 0.23$, $\eta_p^2 = 0.246$] of group on the measures of lexical diversity. Further, univariate analyses were carried out to study the effect of group on each of the three lexical diversity measures considered in the study.

The results of the univariate analyses showed that there was no significant effect of group on NTW [F (2, 27) = 2.806, p = 0.078, η_p^2 = 0.246]. However, the effect of group was significant for NDW [F (2, 27) = 6.565, p = 0.005, η_p^2 = 0.327] and MATTR [F (2, 27) = 5.961, p = 0.007, η_p^2 = 0.306].

The MANOVA was followed by pair-wise comparison between the groups using post-hoc tests. The results of Tukey's Honestly Significant Difference (HSD) for multiple comparisons are presented in Table 4.2. The results revealed that there was no significant difference (p > 0.05) between any of the groups for the measure of NTW. Therefore, the results show that children with SLI and typically developing children matched based on chronological age and expressive language age had similar outcomes for the NTW values. Although the mean value of NTW (Table 4.1) was higher for chronological age matched children than the other two groups, these findings were not statistically significant.

A significant difference in NDW measure was found between the clinical group and control group 1 (p= 0.028) indicating that chronological age matched typically developing children had higher NDW than children with SLI. Similarly, a significant difference was observed (p= 0.005) between participants of the two control groups. However, there was no significant difference (p> 0.05) in the NDW measure between clinical group and control group 2. Hence, the results show that children with SLI and expressive language age matched typical children had similar magnitude of NDW. Chronological age matched children had higher NDW than expressive language age matched typically developing children indicating the improvement in the lexical diversity that occurs with age.

Table 4.2

Results of pairwise comparisons using Tukey's test between the participant groups for lexical diversity measures

Measures	Groups	p value
NTW	Control 1-Clinical	0.107
	Control 2-Clinical	0.993
	Control 1-Control 2	0.134
NDW	Control 1-Clinical	0.028*
	Control 2-Clinical	0.777
	Control 1-Control 2	0.005*
MATTR	Control 1-Clinical	0.220
	Control 2-Clinical	0.208
	Control 1-Control 2	0.005*

Note: *NTW= Number of Total Words, NDW= Number of Different Words, MATTR = Moving Average of Type token Ratio*
*******Significant at p< 0.05*

The MATTR measure of lexical diversity was not found to be significantly different (p> 0.05) for the comparison of clinical group with either of the control groups. On the other hand, there was significant difference between the two control groups (p= 0.005) indicating that older typical children had a higher MATTR value than the younger typical children. Therefore, although not statistically significant, children with SLI were observed to have intermediate MATTR values with the high MATTR value in chronological age matched children and low MATTR value in expressive language age matched children.

In summary, the chronological age matched children had the highest mean values for all the measures of lexical diversity. Expressive language age matched

children had higher mean value of NTW than children with SLI. In contrast, children with SLI had higher mean values for NDW and MATTR than expressive language age matched children who had the least mean values for these measures. A significant group effect was observed for the measures of NDW and MATTR, but not for NTW. Further, post-hoc tests revealed that NDW measure was significantly different between clinical group and control group1 and between the two control groups, whereas MATTR measure was significantly different between the two control groups. Other comparisons did not show significant differences.

4.3 Comparison of mean frequency of different word classes used by clinical group and control groups

The language transcript of each participant was inspected and further analysed qualitatively to get comprehensive information about the frequency of 'word classes' that are used by the participants. The qualitative analysis to study the usage of different word classes focused on 'Nouns', 'Verbs', 'Adjectives', 'Conjunctions', 'Prepositions', 'Pronouns', 'Interrogatives', and 'Interjections'. The use of determiners, quantitatives, copula, auxiliaries, articles, deixies, negatives and functional words were considered under 'other word classes'. The mean frequencies and standard deviations of each of the word classes used by participants from the clinical group and the two control groups are shown in Table 4.3. Figure 4.1 depicts the mean frequency of word classes used across the three participant groups.

Table 4.3 shows that participants in the clinical group used 'nouns' with the highest frequency followed by 'verbs', 'conjunctions' and 'pronouns'. The use of 'adjectives', 'prepositions/postpositions', 'interrogatives' and 'interjections' were

limited in this group. The ‘other word classes’ that were used by children with SLI included determiners, negatives, functional words and deixis as shown in Figure 4.2.

The participants in control group 1 also used ‘nouns’ with the highest frequency. The least frequently used word classes were ‘prepositions/postpositions’ and ‘interjections’. The use of ‘verbs’, ‘conjunctions’, ‘adjectives’ and ‘pronouns’ was more frequent in children belonging to control group 1 than the children in the clinical group. The frequency and consistency in using ‘other word classes’ by the chronologically age matched children was double that of the children with SLI as shown in Table 4.3. The ‘other word classes’ produced by the control group 1 also had a larger variety of words indicating the diversity in the vocabulary. As shown in Figure 4.3, they used determiners, articles, copula, auxiliaries, quotatives, conditional words, deixis, negatives, participles, and quantitative more commonly, thereby indicating greater lexical diversity.

The frequency of use of different word classes in control group 2 showed a trend similar to that of the clinical group. These participants also used ‘nouns’ more commonly followed by ‘verbs’, ‘pronouns’ and ‘conjunctions’. Participants in the control group 2 used ‘adjectives’ and ‘interjections’ with the least frequency as shown in Figure 4.4. However, it is clearly seen that children with SLI did not use ‘pronouns’ as frequently as the participants in control group 2.

Table 4.3

Means and Standard Deviations (SD) of the frequency of word classes used by participants in the clinical and control groups

	Clinical group		**Control group1**		**Control group 2**	
	Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**
Nouns	46.70	9.30	59.40	10.15	46.70	15.49
Verbs	18.60	9.30	26.50	7.32	18.10	10.72
Adjectives	0.30	0.90	1.10	2.51	0.40	1.26
Conjunctions	2.40	2.27	4.10	2.51	3.10	4.43
Prepositions	0.70	1.05	0.70	0.82	1.60	2.50
Pronouns	1.80	1.39	3.50	2.50	3.80	3.15
Interjections	0.30	0.67	0.20	1.48	0.00	3.73
Interrogatives	0.90	1.44	0.90	0.67	2.20	0.00
Other word classes	14.80	9.28	30.70	15.33	24.60	15.07

Although no statistically significant difference was seen between children with SLI and expressive language age matched typical children in the quantitative analysis for NTW, NDW and MATTR, the qualitative analysis revealed differences in the frequency of use of different word classes between these groups. As shown in Figure 4.1, children matched for expressive language age used more complex word classes like ‘conjunctions’, ‘prepositions/postpositions’, ‘pronouns’, and ‘interrogatives’ when compared to children with SLI. In addition, expressive language age matched children showed a greater array of ‘other word classes’ like articles, auxiliaries, deixies, functional words, negatives, and determiners. Therefore, the results of the qualitative

analysis highlight on the higher frequency in the use of different word classes in children who are typically developing when compared to children with SLI indicating that children with SLI have a less mature system of lexicon.

Figure 4.1

Comparison of mean frequency of word classes used across the clinical and control groups

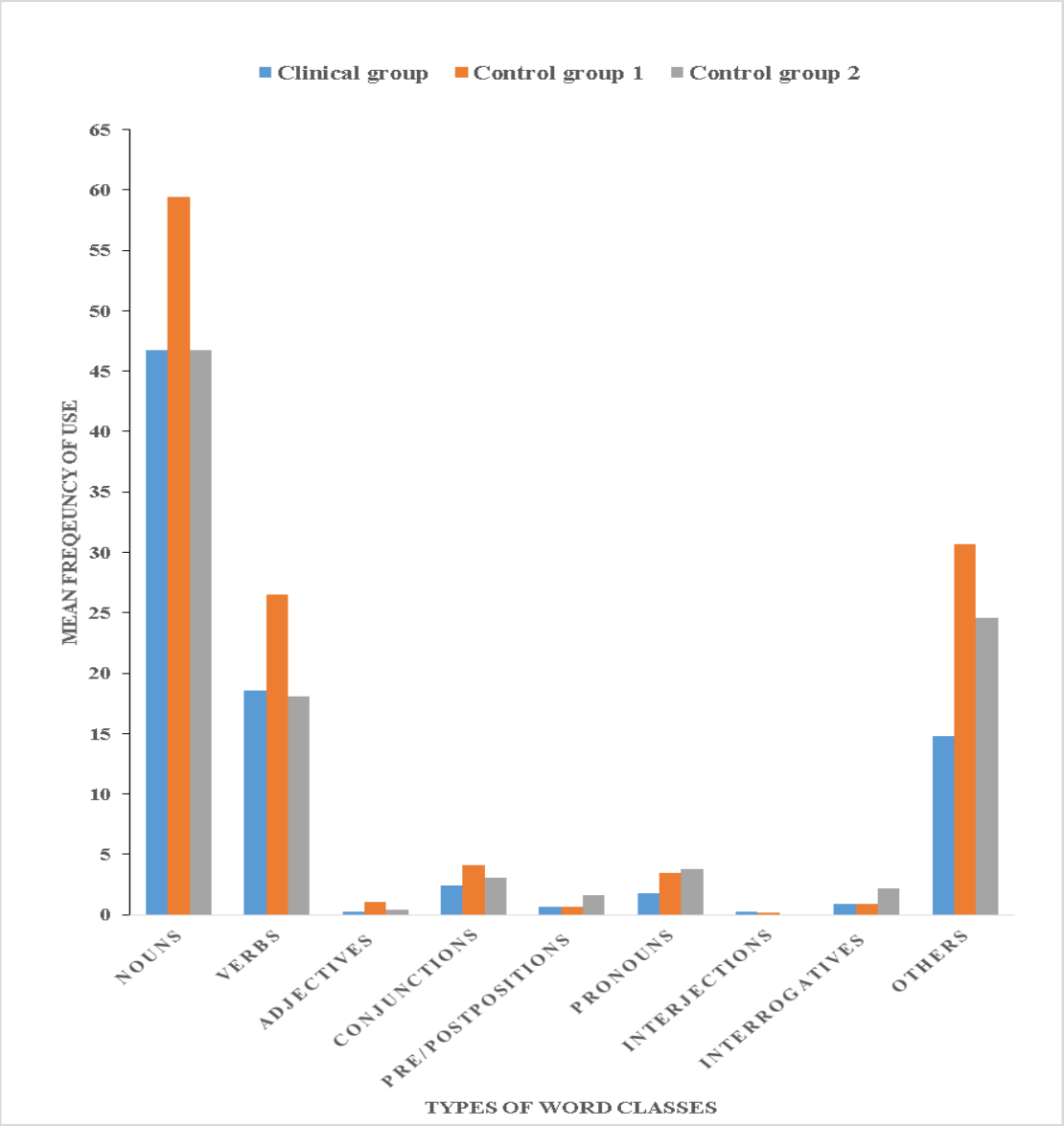


Figure 4.2

Mean frequency (in percentage) of word classes used by participants in the clinical group

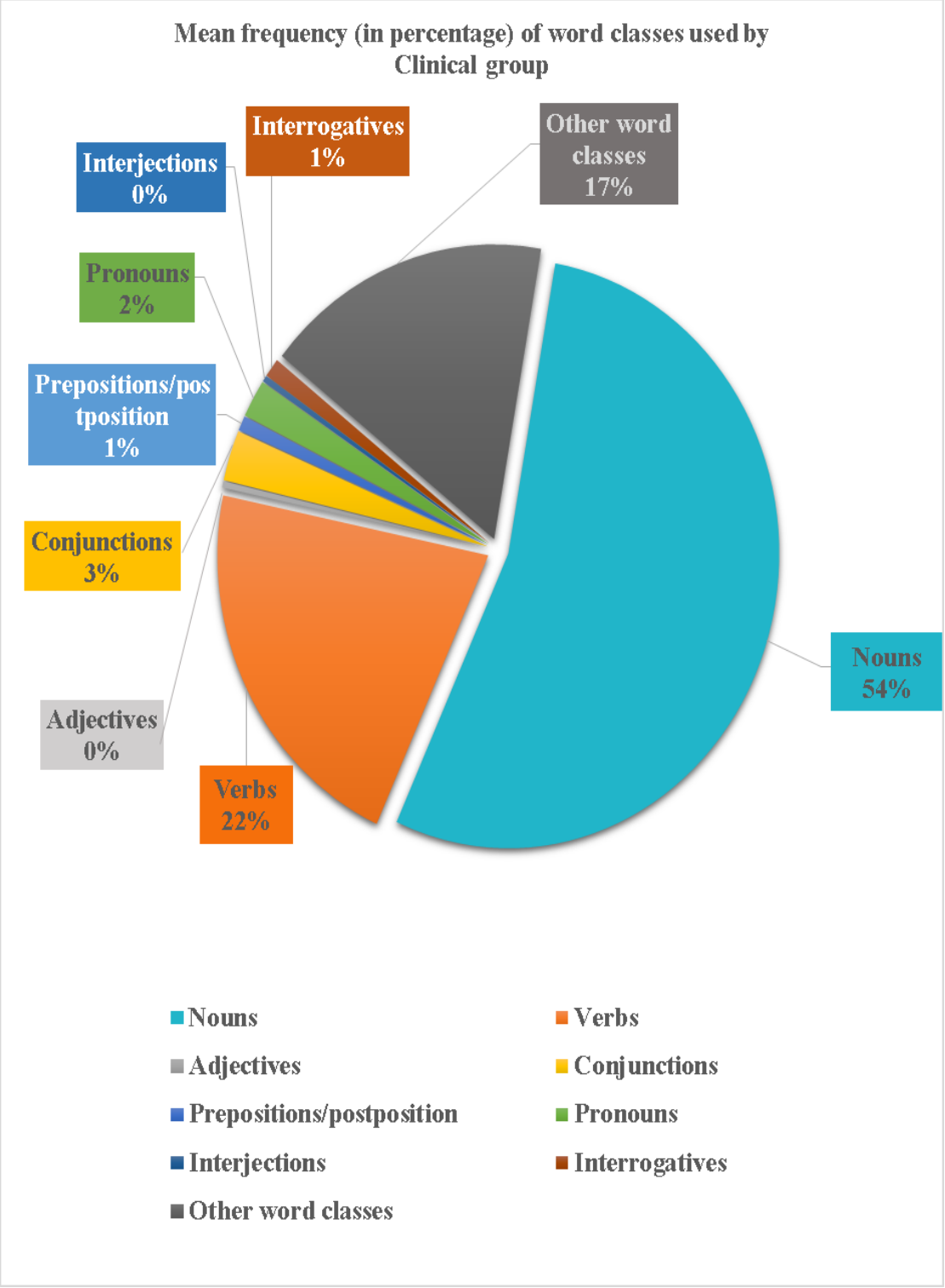


Figure 4.3

Mean frequency (in percentage) of word classes used by participants in the control group 1

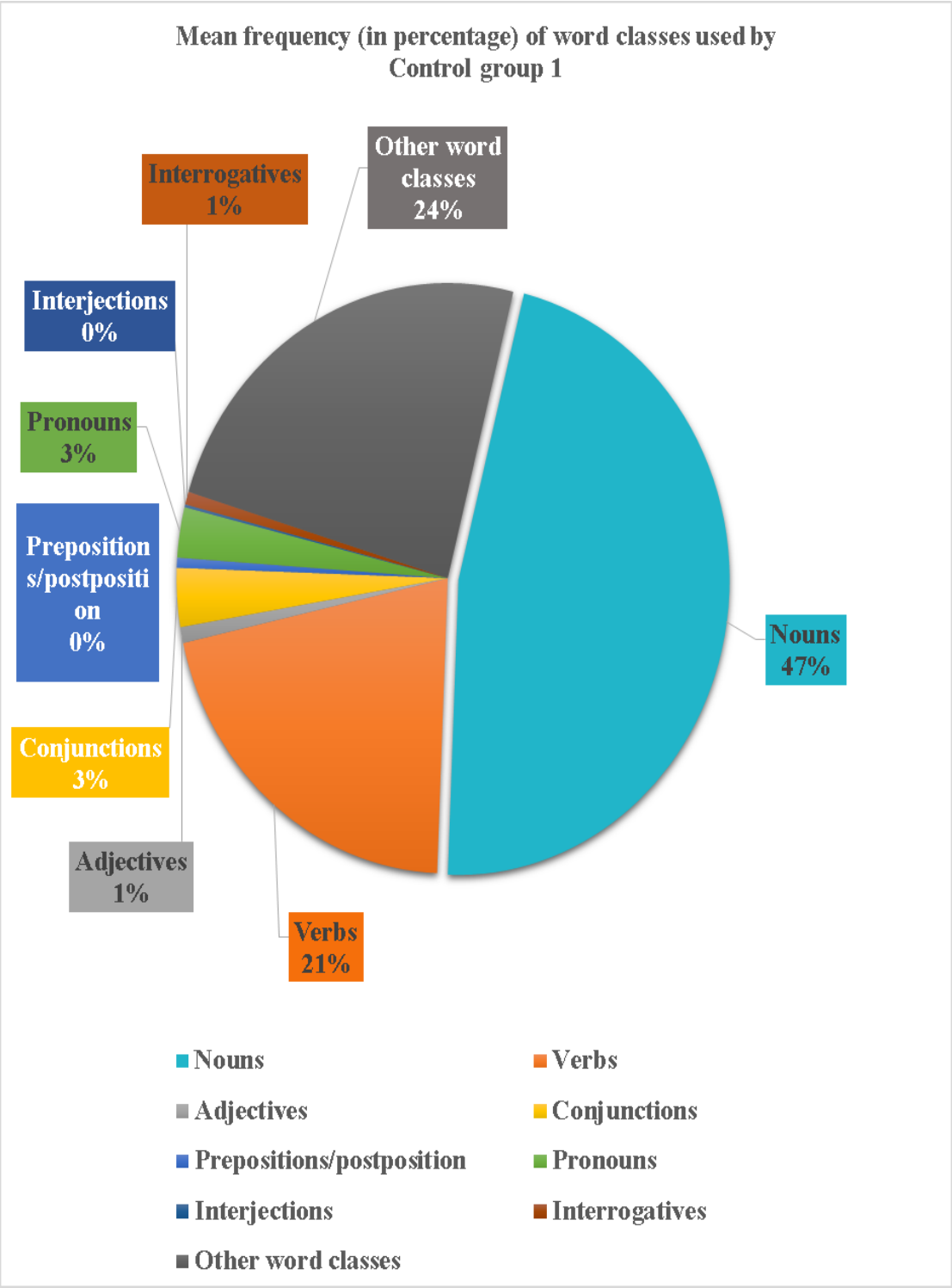
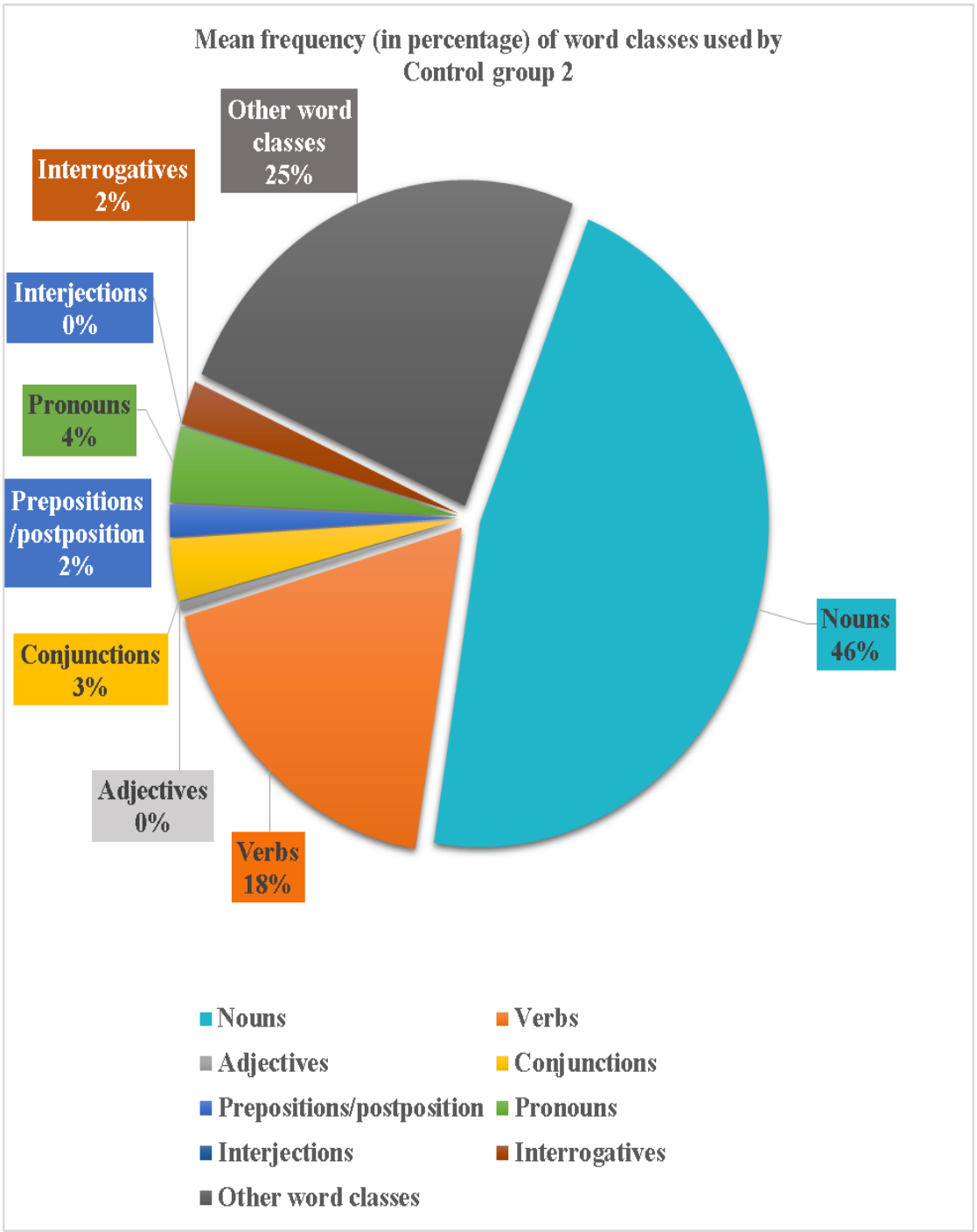


Figure 4.4

Mean frequency (in percentage) of word classes used by participants in the control group 2



4.4 Comparison of code switching and code mixing in by clinical group and control groups

The frequency and classes of words that underwent 'code switching' and 'code mixing', that is, the inter and intra-sentential language shifts between Kannada and English by the participants in each group was analysed to understand their semantic abilities from the bilingual perspective. Table 4.4 shows the mean frequency of code-switching and code-mixing in the three groups of participants.

Comparison of the extent of inter and intra-utterance language shifts between Kannada and English showed that the clinical group had a higher frequency of code-switching (that is, shifting from Kannada to English or vice versa between utterances) than code-mixing (that is, shifting from Kannada to English or vice versa within the specific utterance). The extent of code-switching was the highest in the clinical group followed by chronological age-matched and then the expressive language age-matched typically developing children.

Table 4.4

Mean frequency of code-switching and code-mixing in the clinical and control groups

	Clinical group		**Control group1**		**Control group 2**	
	Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**
Code-switching	17.50	11.80	12.40	9.44	7.30	4.06
Code-mixing	11.20	8.01	20.60	6.99	8.80	7.74

The participants of the control group 1 (Mean = 12.4) had a lesser frequency of code-switching than participants of the clinical group (Mean = 17.5). In contrast, the extent of code-mixing was highest in control group 1 amongst the three groups of

participants. As shown in Table 4.4, in control group 1, code-mixing (Mean = 18.6) occurred more frequently than code-switching (Mean = 12.4). Control group 2 had the least frequency for such language shifts. However, the trend observed in code-mixing and code-switching in participants belonging to control group 2 was similar to control group 1, that is, the participants in control group 2 showed more code-mixing (Mean = 8.8) than code-switching (Mean = 7.3). Therefore, the same pattern of code-switching and code-mixing was seen in both the control groups (that is, frequency of code mixing > frequency of code-switching) and a reverse pattern was observed in the clinical group (that is, frequency of code-switching> frequency of code mixing).

The language sample transcripts of each participant were further analysed to understand the word classes that underwent code-switching and code- mixing. The mean frequency of code-switching and code-mixing across the three participant groups for each of the word classes are shown in Table 4.5. This analysis showed that all the participants had the highest instances of code-switching and code-mixing in the class of ‘nouns’, followed by ‘verbs’. The extent of code-switching and code-mixing is negligible across all the groups for word classes like ‘conjunctions’, ‘pre/postpositions’, ‘adjectives’, ‘pronouns’, ‘interjections’ and ‘interrogatives’. Both the control groups had more instances of code-mixing for ‘nouns’ and ‘verbs’, whereas, the clinical group had more instances of code-switching for ‘nouns’ and ‘verbs’.

Table 4.5

Mean frequency of code-switching and code-mixing for individual word classes in the clinical and control groups.

	Code-switching			Code-mixing		
	Control group	**Clinical group 1**	**Clinical group 2**	**Clinical group**	**Control group 1**	**Control group 2**
Nouns	11.5	9.70	6.10	7.60	17.30	6.40
Verbs	2.30	1.20	0.50	1.20	3.20	0.80
Adjectives	0.00	0.20	0.00	0.00	0.10	0.00
Conjunctions	0.10	0.30	0.20	0.00	0.10	0.10
Prepositions	0.00	0.00	0.00	0.00	0.00	0.00
Pronouns	0.10	0.00	0.10	0.00	0.00	0.00
Interjections	0.00	0.00	0.00	0.00	0.00	0.00
Interrogatives	0.20	0.00	0.00	0.00	0.00	0.00
Other word classes	0.20	0.60	0.40	0.70	0.60	0.10

To summarize, One-way MANOVA followed by pair-wise comparisons using Tukey's HSD was conducted to address the two objectives of the study. With respect to the first objective, there was a statistically significant difference in the measures of NDW between children with SLI and chronological age matched children who are typically developing. This indicates a significantly higher lexical diversity in chronological age matched typically developing children when compared to children with SLI. However, there was no significant difference in NTW and MATTR between these groups. Therefore, the null hypothesis was rejected for the first objective only in terms of NDW.

With respect to the second objective of the study, there was no statistically significant difference in any measure of lexical diversity considered in this study between children with SLI and typical children matched for expressive language age. This indicates that children with SLI and expressive language age matched typically developing children have similar values of NTW, NDW and MATTR. Therefore, the null hypothesis was accepted for the second objective for all the three measures of lexical diversity.

The qualitative data analysis revealed that children with SLI used lesser variety of words when compared to typically developing children matched based on chronological age and expressive language age. Although all three groups had inter- and intra-sentential language shifts predominantly for ‘nouns’ followed by ‘verbs’, the frequency of code mixing was more than code switching in chronological age matched and expressive language age matched typically developing children whereas the opposite trend (i.e. code switching more than code mixing) was seen in children with SLI.

CHAPTER 5

DISCUSSION

The study aimed to compare lexical diversity in children with SLI with that of typically developing children matched for chronological age and expressive language age. The lexical diversity measures considered in the study were Number of Total Words (NTW), Number of Different Words (NDW) and Moving Averages of Type-Token Ratio (MATTR).

The data was analysed quantitatively by subjecting the language transcripts for analysis using SALT Software and computing the three measures of lexical diversity. In addition, the data was analysed qualitatively to determine the frequency of use of different word classes as well as code-switching and/or code mixing.

A significant number of studies have shown that children with SLI have poor semantic skills measured in terms of lexical diversity (Lahey & Edwards, 1996; Paul, 2017; Rapin & Allen, 1983). Rice and Hoffman (2015) did a longitudinal study that tracked the vocabulary and semantic development in individuals with SLI from the age of 2.6 to 21 years and showed that participants with SLI continued to have difficulties in lexical-semantic aspects of language even in adulthood (Rice & Hoffman, 2015). Therefore, it is important to consider the measures of lexical diversity and expand the understanding about the language profiles seen in children with SLI compared to age matched peers. The results of the study are discussed in the following sections.

5.1 Comparison of lexical diversity measures between clinical group and control groups

The results of the present study showed significant difference between children with SLI and typical children matched for chronological age for the measure of NDW, however, there was no difference between the two groups in terms of NTW and MATTR. Nevertheless, children with SLI had reduced mean values for all three measures of lexical diversity in comparison with chronological age matched typical children. Further, it was found that children with SLI did not show any significant differences on the lexical diversity measures when compared to typical children matched for expressive language age.

5.1.1 NTW values in clinical group versus control groups

NTW has been used widely to differentiate children with SLI from their age matched typically developing peers (Ratner et al., 2024; Williams et al., 2013; Wong et al., 2010). Studies have shown that growth trajectories using NTW displayed the ability to identify samples of children with language impairment from the samples of children with typically developing language abilities (Ratner et al., 2024). However, the findings of this study are contradictory to the previous literature on NTW measures. The outcomes of the present study could be explained by three important reasons.

Firstly, as chronological age advances, there is a rapidly increasing vocabulary growth seen in typically developing children, but a slow growing lexical repertoire in children with language impairment. Therefore, the differences in NTW measures between children with and without language impairment becomes more obvious as the age increases. Most of the recent studies have compared the measures of NTW in a

wider age range of children with typical and atypical language development which enables the investigator to obtain a clearer difference in measures of lexical diversity. Consistent with this, Ratner et al. (2024) studied lexical diversity measures in children in the age range of 4 to 11 years and found a significant difference in NTW. In the present study, the participants belonging to the age range of 4 to 8 years were included causing a limitation to explore the developmental influence on NTW measures beyond 8 years of age.

Secondly, the present study focused on evoking the language sample using a picture description task with a limited set of probe questions. This task requires the child to produce language output more spontaneously that inevitably increases the linguistic demands. On the other hand, conversational samples have comparatively lesser linguistic load due to the frequent language inputs provided by the conversation partners that may act as consistent probes to evoke more language outputs from the child (Wong et al., 2010). The reduction in probing in the spontaneous speech task could be speculated to be the reason for obtaining lesser sample size across all the groups. Therefore, future studies could highlight on the effect of task on lexical diversity measures to increase exploration on these measures.

Thirdly, an inspection of the language transcripts of the participants showed that children in all the groups had 50 to 60 utterances in total, although the procedure in evoking language samples did not intend to actively restrict the number of utterances across the participants. Similarity, the length of the sample across all the three groups could be a possible explanation for the results obtained in the present study because having a fixed range in the number of utterances or the total number of tokens across

all the participants adversely affects the measure of NTW (Ratner et al., 2024; Yang et al., 2022). Similarity in the total number of utterances can be speculated to result in the same situation as methodologically restricting the total number of utterances. As recent studies show, this fades away the possibility of the examiner to study the differences in the maximum extent to which children with SLI and typically developing children can produce verbal outputs (Eg: Ratner et al., 2024; Yang et al., 2022). In other words, the full quantitative potential range of verbal productions in children with SLI and expressive language age matched typically developing children could not be studied because of the similarity in number of utterances. However, attributing the statistically insignificant differences in NTW values in samples elicited from children with SLI and chronological age matched typically developing children to the similarity of the sample size is sceptical at this point due to limited exclusive literature on NTW in children with SLI.

By analysing the given factors on NTW, it is plausible to consider four different ways to test the benefits of the NTW measure of lexical diversity. Firstly, language samples could be evoked for as long as the child can speak for a given task and then quantifying the total number of words produced or total number of utterances in the overall sample (Ratner et al., 2024). Another way to incorporate a better use of NTW is by fixing the time duration for evoking language samples instead of fixing the number of utterances or number of words uttered by the child. The third method could be the calculation of NTW by evoking as many utterances and words as possible from each participant without having any pre-set restrictions on the total number of words or utterances. Additional sample-size dependent measures like NDW and MATTR could be calculated using a fixed set of 50 utterances derived from the unrestricted sample

collected for the measurement of NTW. In this way, the SALT analysis has to be done twice using two samples for each participant: first to measure the NTW and second for measuring NDW and MATTR using only 50 utterances. Finally, Yang et al. (2022) suggested that the bias could be overcome by fixing the number of times a probe question is asked, instead of fixing the total number of utterances. This means that the examiner will be probing the child to speak for a fixed number of times, for example, the examiner can use probe questions only 15 times during the elicitation of the language samples from each participant. However, this kind of fixation of prompts is not recommended to solve the existing bias as it may also restrict the length of the sample obtained from children, thereby rendering it insufficient for language sampling (Ratner et al., 2024; Vermeer, 2000). The present study has been designed with six fixed questions, however, it is not fixed in terms of the number of times these six questions could be asked. Therefore, it only specifies ‘what’ the probe questions are, but not ‘how many’ times the probe questions are to be used during language sampling.

Therefore, if at all NTW is a good measure to differentiate between children with and without language impairment, then it would show that children who are typically developing would produce larger NTW than children with language impairment. Also, even when time duration and probes for evoking a language sample from a stimulus is fixed, children with language impairment would produce fewer words than typically developing children.

5.1.2 NDW values in clinical group and control groups

The results of the present study revealed that there was a significant difference in NDW values between children with SLI and children who are chronological age-matched but not expressive language age matched children. These findings are in agreement with the previous literature that have reported.

NDW is a reliable measure of lexical diversity in differentiating between children with language impairment and typically developing children matched for chronological age and expressive language age (Charest et al., 2020; Heilmann et al., 2010; Hewitt et al., 2005, Klee, 1992; Paul, 2005, Price & Jackson, 2015; Thordardottir & Namazi, 2007; Watkins et al., 1995; Williams et al., 2013). Hewitt et al. (2005) highlighted that typically developing kindergarten children used greater NDW than older children with SLI. This is demonstrated by the lesser repetition of the same word in a given context by typically developing children (Paul, 2017). A regression model for the lexical diversity measures found that NDW values increased with age indicating growth trajectories in typically developing children but not for children with language impairment (Yang et al., 2022). On the other hand, NDW did not differentiate between younger children with and without language impairment, making the use of NDW a risky measure for language sampling in younger children due to the increased degree of developmental variability (Fey et al., 2004; Yang et al., 2022). Also, NDW varies with the total number of utterances or sample length which makes it less reliable depending on the population that is studied (Yang et al., 2022). Therefore, this shows that there are contradictory evidences against the use of NDW measures for clinical purposes due to variations related to age and sample size.

Another aspect to consider is that as children grow older, their linguistic demands increase. Children with SLI may not be able to meet the language demands due to inherently limited language capacities (Almubark et al., 2023). This is seen in the NDW growth trajectories which diverge from typically developing children after about 5 to 6 years indicating that NDW increases in typical children as their age increases, whereas, children with language impairment may struggle to match with their age matched peers (Almubark et al., 2023; Yang et al., 2022; Ratner et al., 2024). Some studies indicate contradicting findings that the difference in NDW values between typical and atypical language samples diminished in older children. Some authors attribute this kind of discrepancy to the methodological and developmental factors (Scott & Windsor, 2002; Watkins et al., 1995). The dependence of NDW on the sample size and the elicitation procedure explains the variability in the results obtained and hence, warrants future research.

Additionally, as the task becomes more self-generated, the variation in lexical diversity measures like NDW increases (Fey et al., 2004; Mills et al., 2013; Nelson & Van Meter, 2007; Scott & Windsor, 2002; Wood et al., 2019; Yang et al., 2022). Also, NDW measures might not be able to project the differences in the samples evoked by children across different age ranges or children with typical and atypical language. In other words, NDW becomes a measure that is not developmentally or clinically sensitive if the factors of methods and development are not carefully controlled (Mills et al., 2013; Nelson & Van Meter, 2007; Wood et al., 2019).

5.1.3 MATTR values in clinical group and control groups

In the present study, there was no statistically significant difference between children with SLI and chronological age matched typically developing children. The results obtained in this study are in partial agreement with the previous research on MATTR. While several authors report that MATTR is a good measure of lexical diversity in clinical populations (Charest et al., 2020; Covington & McFall, 2010; Kapantzoglou et al., 2017; McCarthy & Jarvis, 2007; Wright et al., 2003), there are also contradictory findings about the use of MATTR (Owen & Leonard, 2002; Ratner et al., 2024; Richards, 1986; Yang et al., 2022).

Yang et al. (2022) found that MATTR measures were reliable for language samples obtained from children less than 4 years of age. The lack of reliability in MATTR for children older than 4 years is attributed to the simultaneous grammatical development (Cunningham & Haley, 2020; Fergadiotis, et al., 2013). Therefore, MATTR becomes a poor outcome in older children because of the higher probability of using non-lexical (that is, grammatical or functional words; Eg: ‘is’, ‘was’, ‘to’) words frequently with increase in the length of the sample. This paints a false picture about NTW and NDW in the sample because the repeated use of non-lexical words gives rise to a greater NTW, but not to the NDW, thereby, reducing the TTR value. If a moving average of TTR measured with this bias is considered, then it would not show reliability in differentiating between typical and atypical language samples. Older chronological age matched children with no language impairment use increased number of grammatical constructions and functional words than children with SLI (Bishop & Norbury, 2002; Leonard, 1998; Prasitha & Prema, 2021; Tiwari et al., 2017), and therefore could have unreliable MATTR values.

Additionally, language sampling procedures are reported to be affected by 'length of the sample', or the 'sample size' (Cole et al., 1989; Garvin & Giles, 1996; Guo & Eisenberg, 2015; Rondal & DeFays, 1978). Guo and Eisenberg (2015) found that NDW and MATTR differed significantly and were not reliable for shorter parent-elicited sample length of less than 7 minutes (50 to 100 utterances). Generally, a sample length of 10 to 15 minutes or longer is recommended to obtain more reliable measures (Owen & Leonard, 2002; Paul & Norbury, 2012). The results of the present study is subject to variation with respect to sample length. The sample size ranged between 50 to 60 words in the present study and the time taken to elicit the same varied between 5 to 12 minutes. These factors would have led to the lack of difference between the subject groups for the measure of MATTR. Future studies in lexical diversity research could be taken up by carefully considering these factors.

5.2 Qualitative analysis of word classes used by clinical group versus control groups

The qualitative analysis that aimed at finding the word classes used by children of the three groups showed that children with SLI used 'nouns' followed by 'verbs' predominantly. Both chronological age matched and expressive language age matched typical children used other word classes (like interrogatives, conjunctions, pre/postpositions, and deixies) more frequently than children with SLI.

These findings draw support from similar reports in the literature stating that children with SLI showed similar mean values for the proportion of 'nouns' as compared to age matched typically developing children, but have difficulties in 'verbs'

(Fenson et al., 1994; Fletcher & Peters, 1984; Normand & Chevrie-Muller,1991; Rice et al., 2015; Watkins et al., 1993; Williams et al., 2013). Studies also show that children with SLI used less mature inflections and verb forms (Bishop et al., 2013; Conti-Ramsden and Jones, 1997). Most reports on word classes in the literature are dominated by studies on 'nouns' and 'verbs'. A few studies have explored and found that the use of other word classes like adjectives (Davis et al., 2023), prepositions (Marina et al., 2005), interrogatives (Deevy & Leonard, 2004; Friedmann & Rama, 2011) and conjunctions (Gonzalez et al., 2012) by children with SLI are affected when compared to typically developing children. This difficulty persists in school age and also hinders academic performances of children with SLI (Ebbels et al., 2014; Davis et al., 2023; Leonard et al., 2019; Oetting et al., 1995). It was found that children with SLI had markedly reduced mean frequency values for the use of complex linguistic categories of words like auxiliaries, copula, negatives, deixis, and quantitatives (Rice & Hoffman, 2015; Rice & Oetting, 1993; Thornton et al., 2016). All of these studies attribute the findings of reduced variety in vocabulary to the poorer development of the linguistic system and a wide array of lexical-semantic difficulties in children with SLI.

On the other hand, there are a few studies that show that younger children with or without SLI show similar distribution of word classes as age increases (Hick et al., 2002; Leonard et al., 1982). It is thus hypothesized that children with SLI may have increasing difficulties with use of different word classes only as age increases. This could be related to the need for children to meet the increasing linguistic demands as they grow older (Conti-Ramsden and Jones, 1997; Watkins et al., 1993).

Therefore, the present study adds to the evidence in the literature reporting that children with SLI develop ‘nouns’ faster than ‘verbs’ and all other word classes. Children with SLI have difficulty in using different word classes that indicate reduced lexical diversity in this clinical population when compared with typically developing children. Despite the statistically insignificant difference in lexical diversity measures between groups of the study, qualitative analysis showed that there was a sparse variety of word classes used by children with SLI while typically children used richer variety.

5.3 Code-mixing and code-switching in clinical group versus control groups

The present study highlights the existence of opposing patterns in code-mixing and code-switching in children with SLI and the two groups of typically developing children.

5.3.1 Code-switching in children with SLI

Children with SLI had a greater frequency of code-switching than age matched and expressive language age matched typically developing children. There are two broad viewpoints about code-switching and code-mixing which could be speculated to understand the results of the present study. Firstly, children with SLI might switch to the second language to compensate for the reduced linguistic competence in the first language (Eg: Rezzonico et al., 2015). Alternatively, code-switching could even be a sign of increased linguistic sophistication and competence and hence, the ability to code-switch is unaffected in children with SLI (Eg: Christou et al., 2021; Gutiérrez-Clellen et al., 2012; Yow et al., 2018).

The first interpretation fits well with the findings of this study by projecting the idea that children with SLI had higher frequency of code-switching because of reduced linguistic competence. This could be explained by knowing that although children with SLI had an increased number of code-switching instances, it was still less mature than that seen in the control groups. Typically developing children used longer utterance length when they demonstrate inter-sentential code-switching between two languages (E.g. “A girl is playing with the boat”, “Two boys are playing shuttle cock”, and “Girl is eating ice-cream”). However, children with SLI used only one or two words while code-switching. They used shorter frames of language to express a bigger idea (Eg: “Ball this”, “What this is”, and “Girl running”).

The present study also throws light on the word classes that were most subject to code-switching. All children, with or without language impairment, switched to English from Kannada for ‘nouns’ followed by ‘verbs’ most frequently. ‘Nouns’ and ‘verbs’ are the most frequently used class of words in the general discourse of the children from all three groups and therefore, the same pattern is seen even in the frequency of word classes studied for code-switching. Additional factors (such as language dominance, age of exposure to the second language, type of bilingualism, and language used while testing) are also known to affect the outcomes of the studies done in the bilingual context (Gutiérrez-Clellen et al., 2012). However, the ideas in this direction of bilingualism in children with SLI continue to be an enigma.

5.3.2 Code-mixing in children with SLI

The results of the present study show that children with SLI had the least number of code-mixing instances, although code-switching was maximally seen in this group. Chronological age matched and expressive language age matched typically developing children mixed two languages within a sentence more frequently when compared to children with SLI. The ability to fit words from second language into the appropriate grammatical and syntactic frames of the first language requires greater linguistic sophistication. The insufficiency of such intricate language competence in children with SLI (Aguilar-Mediavilla et al., 2015) could be a cogent reason for the findings of the present study. Similar to code-switching, 'nouns' and 'verbs' were subjected to code-mixing for greater number of times by all three groups of children. There is abundance of literature in the area of code-switching and code-mixing in bilingual children whose language development meets the norms, including the Indian context (Prasad & Rao, 2011). However, studies that throw light on code-mixing in children with SLI are fewer in number, thereby, leading to inconclusive understanding about code-switching and code-mixing in this population. Future studies in this direction, particularly in the Indian context, may provide better understanding about code-switching and code-mixing in children with language impairment.

To conclude, the present study highlights the need to complement standardized language assessment of children with SLI using different culturally and linguistically sensitive measures obtained through language sampling. Lexical diversity measured using language sampling in children with SLI projects a broader dimension of understanding than that obtained from traditional standardized test procedures. The present showed that there was a significant difference between chronological age

matched typically developing children and children with SLI for NDW measure of lexical diversity. Although there was no significant differences in the other lexical diversity measures, qualitative analysis revealed that the children with SLI used lesser variety of word classes compared to chronological and expressive language age matched children. Also, the discrepancy in the patterns of code-switching and code-mixing in children with SLI indicated poorer lexical diversity and an overall reduction in linguistic competence.

CHAPTER 6

SUMMARY AND CONCLUSIONS

The aim of the present study was to compare the lexical diversity measures between children with SLI and typically developing children. The study was conducted with two main objectives. The first objective was to compare the lexical diversity measures of (a) Number of Total Words (NTW), (b) Number of Different Words (NDW) and (c) Moving Averages of Type-Token Ratio (MATTR) between the chronological age matched typically developing and SLI group of participants. The second objective was to compare the same measures of lexical diversity between the expressive language age matched typically developing and SLI group of participants.

A total of 30 Kannada-speaking participants belonging to the middle social-economic status were included in the study and they were classified into three groups. The clinical group constituted of 10 children with SLI (selected based on Leonard's criteria) in the age range of 4 to 8 years. The study had two control groups, namely control group 1 that included 10 chronological age matched typical children and control group 2 with 10 typical children matched for expressive language age of the participants in the clinical group. Assessment of Language Development (ALD) was used to find the expressive language of the participants in order to appropriately match them. All the participants were subjected to picture description task and a fixed set of probe questions were used while evoking language samples. The utterances produced by each participant was audio-recorded using an inbuilt microphone in the android device. These recordings were utilized to transcribe the utterances produced by the participants of each group, following which the language transcripts were subjected to analysis on

the SALT software to compute three measures of lexical diversity- NTW, NDW and MATTR.

The data thus obtained were subjected to suitable statistical procedures. Results of One way-MANOVA showed that there was a significant difference only for NDW between children with SLI and chronological age matched typically developing children. There were no significant differences between the two groups for the measures of NTW and MATTR. On the other hand, there was no statistically significant difference for any of the lexical diversity measures (NTW, NDW and MATTR) between children with SLI and expressive language age matched typically developing children. With respect to the primary objectives of the study, the null hypotheses were accepted for all the measures except for NDW values compared between children with SLI and control group 1. Therefore, it is interpreted that children with SLI had similar values of NTW, NDW and MATTR as that of younger typical children matched for expressive language age but had significantly reduced NDW values than chronological age matched typical children. The results of the present study support the notion of poor lexical-semantic abilities in children with SLI compared to typically developing peers. These findings also direct at the inherently limited lexical diversity in children with SLI thereby reducing their ability to cope up with the increasing linguistic demands with increase in age. Further, considering the influence of age and sample size on the measures of lexical diversity, controlled use of these measures is warranted.

Qualitative analyses of the data shed light on the fact that children with SLI used ‘nouns’ and ‘verbs’ more frequently than other word classes, similar to what was found in the two control groups. However, children belonging to the two control groups

demonstrated greater use of 'interrogatives', 'conjunctions' and 'other word classes' (which included negatives, deixies, determiners, functional words, auxiliaries, copula and articles). Clearly, children with SLI had marked restriction in the use of word classes thereby indicating reduced lexical diversity in this clinical population. Furthermore, the language transcripts were analysed to identify instances of code-switching and code-mixing. Interestingly, it was found that children with SLI had the greatest number of code-switching instances than both the control groups, but the number of code-mixing instances were the least. It is speculated that increased code-switching is indicative of potential linguistic incompetence in children with SLI. Likewise, the lack of ability to shift the use of lexical items between languages and to fit the words from one language appropriately into the syntactic frame of another language may explain reduced frequency of code-mixing. In addition, the word classes on which code-switching and code-mixing occurred was noted. This showed that children with SLI and typically developing children code-switched and code-mixed on 'nouns' and 'verbs' most often.

To conclude, the results of the study highlight that children with SLI have poorer lexical diversity when compared to younger and older typical children, thereby indicating that SLI population has marked deficits in lexical-semantic abilities. These findings emphasize on the need to include assessment of lexical diversity measures through language sampling a part of the routine clinical evaluation for children with SLI. Further, it strengthens the need to target lexical-semantic aspects during language intervention for these children.

6.1 Implications of the study

- The results of the study provides a deeper insight into the lexical diversity of children which is not easily evidenced when assessed using a standardized assessment tool.
- A lexical diversity measure through language sample analysis aids in the assessment of a child's semantic abilities in a highly individualized manner, thereby eliminating the effects of cultural and linguistic biases.
- The study highlights the insights offered into understanding lexical diversity when quantitative analysis is backed up by qualitative analysis.
- Measures such as the ones targeted in this study can provide valuable information for setting goals in intervention.
- Lexical diversity measures can be used by clinicians to evaluate the outcome of language intervention.

6.2 Limitations of the study

- The study considered children with SLI in the age range of 4 to 8 years. The smaller age range could have limited the understanding about how lexical diversity measures vary with age in children with and without SLI.
- The number of male and female participants were not balanced in the present study. The gender differences in lexical diversity measures, if any, may have been missed out.
- The study included only 10 participants in each group, whereas a larger sample size would have increased the scope of generalization of the findings.

6.3 Future directions

- The reliability of lexical diversity measures is recommended to be studied extensively by controlling the potential biases due to various influencing factors such as effect of sample length, age of the participants, software algorithms, instructions given, and linguistic demands of the tasks (spontaneous speech, conversation, narration etc).
- Measures of lexical diversity for typically developing children as well as children with language impairments can be studied across a wider age range to understand the developmental influences.
- The potential benefit of using language sampling procedures along with standardized test materials can be explored further to shed light on the their clinical implications.
- Future research can be carried out to understand patterns of code-switching and code-mixing in bi/multilingual children in the Indian context, both with and without language impairments.

REFERENCES

Aguilar-Mediavilla, E., Buil-Legaz, L., Pérez-Castelló, J. A., López-Penadés, R., & Adrover-Roig, D. (2015). Code-switching in bilingual Spanish- Catalan children with Specific Language Impairment. *Proceedings in Studies in Bilingualism*, Eds C. dos Santos and L. de Almeida (Amsterdam: John Benjamins Publishing Company).

Alduais, A., Alfadda, H., Allegretta, S., & Trivkovic, T. (2023). Pragmatic Language Impairment: A Scientometric Review. *Applied Sciences. 13*, 9308. https://doi.org/10.3390/app13169308

Almubark, N. M., Silva-Maceda, G., Foster, M. E., & Spencer, T. D. (2023). Indices of narrative language associated with disability. *Children (Basel, Switzerland), 10*(11), 1815. https://doi.org/10.3390/children10111815

Alt, M., & Plante, E. (2006). Factors that influence lexical and semantic fast mapping of young children with specific language impairment. *Journal of Speech, Language, and Hearing Research. 49*(5), 941–954. https://doi.org/10.1044/1092-4388(2006/068)

Alt, M., Plante, E., & Creusere, M. (2004). Semantic features in fast-mapping: performance of preschoolers with specific language impairment versus preschoolers with normal language. *Journal of Speech, Language, and Hearing Research*, *47*(2), 407–420. https://doi.org/10.1044/1092-4388(2004/033)

American Speech-Language-Hearing Association (n.d.). *Spoken Language Disorders.* (Practice Portal). Retrieved on November 15, 2023 from www.Practice-Portal/Clinical-Topics/Spoken-Language-Disorders.

Anitha, R. (2003).*Computerized Linguistic Protocol for Screening (CLIPS).* (Dissertation Number: 496). [Unpublished Master's Dissertation, University of Mysore]

Arabpour, M., Nakhshab, M., Humphry, S., & Kazemi, Y. (2023). Systematic Analysis of Language Transcripts' (SALT) transcribing method and Narrative Assessment Protocol (NAP) online coding method: are they interchangeable?. *Logopedics, Phoniatrics, Vocology*, *48*(1), 35–43. https://doi.org/10.1080/14015439.2021.1986572

Archibald, L. M., & Joanisse, M. F. (2012). Atypical neural responses to phonological detail in children with developmental language impairments. *Developmental Cognitive Neuroscience*, *2*(1), 139–151. https://doi.org/10.1016/j.dcn.2011.07.003

Armon-Lotem, S. (2012). Introduction: Bilingual children with SLI – the nature of the problem. *Bilingualism: Language and Cognition*, *15*(1), 1–4. doi:10.1017/S1366728911000599

Auza B, A., Murata, C., & Peñaloza, C. (2023). Predictive validity of a parental questionnaire for identifying children with developmental language disorders *Frontiers in Psychology*, *14*. https://doi.org/10.3389/fpsyg.2023.1110449

Baese-Berk, M. M., Drake, S., Foster, K., Lee, D. Y., Staggs, C., & Wright, J. M. (2021). Lexical Diversity, Lexical Sophistication, and Predictability for speech in multiple listening conditions. *Frontiers in Psychology*, *12*. https://doi.org/10.3389/fpsyg.2021.661415

Betz, S. K., Eickhoff, J. R., & Sullivan, S. F. (2013). Factors influencing the selection of standardized tests for the diagnosis of specific language impairment. *Language, Speech, and Hearing Services in Schools*, *44*(2), 133–146. https://doi.org/10.1044/0161-1461(2012/12-0093)

Binger, C., Ragsdale, J., & Bustos, A. (2016). Language sampling for preschoolers with severe speech impairments. *American Journal of Speech-Language Pathology*, *25*(4), 493–507. https://doi.org/10.1044/2016_AJSLP-15-0100

Bishop D. V. M. (2006). What causes Specific Language Impairment in children?. *Current Directions in Psychological Science*, *15*(5), 217–221. https://doi.org/10.1111/j.1467-8721.2006.00439.x

Bishop D. V. M. (2010). Overlaps between autism and language impairment: phenomimicry or shared etiology?. *Behavior Genetics*, *40*(5), 618–629. https://doi.org/10.1007/s10519-010-9381-x.

Bishop D. V. M. (2013). Problems with tense marking in children with specific language impairment: not how but when. *Philosophical Transactions of the Royal Society of London. Series B, Biological sciences*, *369*(1634). https://doi.org/10.1098/rstb.2012.0401

Bishop, D. V. M., & Leonard, L. B. (Eds.). (2014). *Speech and language impairments in children: causes, characteristics, intervention and outcome*. Psychology Press.

Bishop, D. V.M., Maybery, M., Wong, D., Maley, A., Hill, W., & Hallmayer, J. (2004). Are phonological processing deficits part of the broad autism phenotype?. *American Journal of Medical Genetics. Part B, Neuropsychiatric Genetics : The Official Publication of the International Society of Psychiatric Genetics*, *128B*(1), 54–60. https://doi.org/10.1002/ajmg.b.30039

Bishop D.V.M., & McDonald D. (2009). Identifying language impairment in children: combining language test scores with parental report. *International Journal of Language and Communication Disorders. 44.* 600–615. https://doi.org/10.1080/13682820802259662

Bishop, D. V. M., & Norbury, C. F. (2002). Exploring the borderlands of autistic disorder and specific language impairment: a study using standardised

diagnostic instruments. *Journal of Child Psychology and Psychiatry, and Allied Disciplines*, *43*(7), 917–929. https://doi.org/10.1111/1469-7610.00114

Boek, W. M., Keleş, N., Graamans, K., & Huizing, E. H. (1999). Physiologic and hypertonic saline solutions impair ciliary activity in vitro. *The Laryngoscope*, *109*(3), 396–399. https://doi.org/10.1097/00005537-199903000-00010

Bortolini, U., & Leonard, L. B. (2000). Phonology and children with specific language impairment: status of structural constraints in two languages. *Journal of Communication Disorders*, *33*(2), 131–150. https://doi.org/10.1016/s0021-9924(99)00028-3

Bortolini, U., Caselli, M. C., Deevy, P., & Leonard, L. B. (2002). Specific language impairment in Italian: the first steps in the search for a clinical marker. *International Journal of Language & Communication Disorders*, *37*(2), 77–93. https://doi.org/10.1080/13682820110116758

Briggs, C. L. (1986). *Learning how to ask: A Sociolinguistic appraisal of the role of the interview in social science research* (1st edition). Cambridge University Press. https://doi.org/10.1017/CBO9781139165990

Bullard, L., McDuffie, A., & Abbeduto, L. (2017). Distance delivery of a parent-implemented language intervention for young boys with fragile X syndrome. *Autism & Developmental Language Impairments*, *2*. https://doi.org/10.1177/2396941517728690

Bunta, F., Fabiano-Smith, L., Goldstein, B., & Ingram, D. (2009). Phonological whole-word measures in 3-year-old bilingual children and their age-matched monolingual peers. *Clinical Linguistics & Phonetics*, *23*(2), 156–175. https://doi.org/10.1080/02699200802603058

Calder, S., Stirling, C., Glisson, L., Goerke, A., Kilpatrick, T., Koch, L., Taylor, A., Wells, R., & Claessen, M. (2017). Language sample analysis: a powerful tool in the school setting. *Journal of Clinical Practice in Speech-Language Pathology*. *19.* 66.

Charest, M., Skoczylas, M. J., & Schneider, P. (2020). Properties of Lexical Diversity in the Narratives of Children with Typical Language Development and Developmental Language Disorder. *American Journal of Speech-Language pathology*, *29*(4), 1866–1882. https://doi.org/10.1044/2020_AJSLP-19-00176

Christou, S., Sanz-Torrent, M., Coloma, C. J., Guerra, E., Araya, C., & Andreu, L. (2021). Real-time comprehension of Spanish prepositions and prepositional locutions in bilingual children with developmental language disorder: A study based on eye-movement evidence. *International Journal of Language & Communication Disorders*, *56*(1), 51–71. https://doi.org/10.1111/1460-6984.12581

Claessen, M., Leitão, S., Kane, R., & Williams, C. (2013). Phonological processing skills in specific language impairment. *International Journal of Speech Language Pathology*, 15(5), 471–483. https://doi.org/10.3109/17549507.2012.753110

Cole, K., Mills, P., & Dale, P. (1989). Examination of Test-Retest and Split-Half Reliability for Measures Derived from Language Samples of Young Handicapped Children. *Language Speech and Hearing Services in Schools. 20.* 259. https://doi.org/10.1044/0161-1461.2003.259

Conti-Ramsden, G. and Jones, M. (1997). Verb use in specific language impairment. *Journal of Speech and Hearing Research. 40*, 1298–313

Conti-Ramsden, G., & Botting, N. (1999). Classification of children with specific language impairment: longitudinal considerations. *Journal of Speech, Language, and Hearing Research, 42*(5), 1195–1204. https://doi.org/10.1044/jslhr.4205.1195

Conti-Ramsden, G., Mok, P. L., Pickles, A., & Durkin, K. (2013). Adolescents with a history of specific language impairment (SLI): strengths and difficulties in social, emotional and behavioral functioning. *Research in Developmental Disabilities*, *34*(11), 4161–4169. https://doi.org/10.1016/j.ridd.2013.08.043

Costanza-Smith, A. (2010). The Clinical Utility of Language Samples. *Perspectives on Language Learning and Education*. *17*(1). 9-15. https://10.1044/lle17.1.9.

Covington, M. A., & McFall, J. D. (2010). Cutting the Gordian knot: The moving-average type-token ratio (MATTR). *Journal of Quantitative Linguistics*, *17*(2), 94–100. https://doi.org/10.1080/09296171003643098

Cunningham, K. T., & Haley, K. L. (2020). Measuring Lexical Diversity for Discourse Analysis in Aphasia: Moving-Average Type-Token Ratio and Word Information Measure. *Journal of Speech, Language, and Hearing Research. 63*(3), 710–721. https://doi.org/10.1044/2019_JSLHR-19-00226

Davies, C., Ebbels, S., Nicoll, H., Syrett, K., White, S., & Zuniga-Montanez, C. (2023). Supporting adjective learning by children with Developmental Language Disorder: Enhancing metalinguistic approaches. *International Journal of Language & Communication Disorders*, *58*(2), 629–650. https://doi.org/10.1111/1460-6984.12792

De Jong, J. (1999). *Specific language impairment in Dutch: inflectional morphology and argument structure*. [Thesis fully internal (DIV), University of Groningen].

Denman, D., Cordier, R., Munro, N., Kim, J. H., & Speyer, R. (2023). Standardized Measures Used Regularly by Speech-Language Pathologists when Assessing the Language Abilities of School-Aged Children: A Survey. *Folia Phoniatrica Et Logopaedica*, *75*(5), 334–349. https://doi.org/10.1159/000530718

Deevy, P., & Leonard, L. B. (2004). The comprehension of wh-questions in children with specific language impairment. *Journal of Speech, Language, and Hearing Research. 47*(4), 802–815. https://doi.org/10.1044/1092-4388(2004/060)

Diani, I., & Azwandi, A. (2021). Phonological change processes of English and Indonesian *Journal of Applied Linguistics and Literature*, *6*, 133-148. 10.33369/joall.v6i1.13642.

Diddee, H. (2013). *Code mixing and Code switching in Hindi-English Bilingual Children.* [Unpublished Masters Dissertation, University of Mysore].

Dodd, B., Holm, A., Hua, Z., & Crosbie, S. (2003). Phonological development: A normative study of British English-speaking children. *Clinical Linguistics & Phonetics*, *17*(8), 617–643. https://doi.org/10.1080/0269920031000111348

Dunn, L. M., & Dunn, D. M. (2012). *Peabody Picture Vocabulary Test—Fourth Edition* [Dataset]. https://doi.org/10.1037/t15144-000

Dowden, P. (1997). Augmentative and alternative communication decision making for children with severely unintelligible speech. *Augmentative and Alternative Communication*, *13*, 48–58.

Ebbels, S.H., Marić, N., Murphy, A. & Turner, G. (2014) Improving comprehension in adolescents with severe receptive language impairments: a randomized control trial of intervention for coordinating conjunctions. *International Journal of Language & Communication Disorders*, *49*(1), 30-48

Edwards, J., Lahey, M. (1998). Nonword repetitions of children with specific language impairment: Exploration of some explanations for their inaccuracies. *Applied Psycholinguistics. 19.* 279–309.

Eisenberg, S. (2001). Use of MLU for identifying Language impairment in preschool children: A review. *American Journal of Speech-Language Pathology. 10.* 10.1044/1058-0360(2001/028).

Ellis, C., Holt, Y. F., & West, T. (2015). Lexical diversity in Parkinson's disease. *Journal of clinical movement disorders*, *2*, 5. https://doi.org/10.1186/s40734-015-0017-4

Ervin, M. (2001). SLI: What We Know and Why It Matters. *The ASHA Leader*, *6*(12), 4–31. https://doi.org/10.1044/leader.FTR1.06122001.4

Evans J. L. (1996). SLI subgroups: interaction between discourse constraints and morphosyntactic deficits. *Journal of Speech and Hearing Research*, *39*(3), 655–660. https://doi.org/10.1044/jshr.3903.655

Evans, J. L., & Craig, H. K. (1992). Language sample collection and analysis: Interview compared to freeplay assessment contexts. *Journal of Speech, Language, and Hearing Research*, 35(2), 343–353. https://doi.org/10.1044/jshr.3502.343

Fenson, L., Dale, P., Reznick, J. S., Bates, E., Thal, D. & Pethick, S. J. 1994: Variability in early communicative development. *Monographs of the Society for Research in Child Development 18*, 32–123

Fergadiotis, G., Wright, H, H. (2011) Lexical diversity for adults with and without aphasia across discourse elicitation tasks. *Aphasiology.25* (11):1414–1430.

Fergadiotis, G., Wright, H. H., & West, T. M. (2013). Measuring lexical diversity in narrative discourse of people with aphasia. *American Journal of Speech-Language Pathology*, *22*(2), S397–S408. https://doi.org/10.1044/1058-0360(2013/12-0083)

Fey, M. E., Catts, H. W., Proctor-Williams, K., Tomblin, J. B., & Zhang, X. (2004). Oral and written story composition skills of children with language impairment. *Journal of Speech, Language, and Hearing Research*. *47*(6), 1301–1318. https://doi.org/10.1044/1092-4388(2004/098)

Finestack, L. H., Payesteh, B., Disher, J. R., & Julien, H. M. (2014). Reporting child language sampling procedures. *Journal of Speech, Language, and Hearing Research*. *57*(6), 2274–2279. https://doi.org/10.1044/2014_JSLHR-L-14-0093

Fletcher, P. and Peters, J. 1984: Characterizing language impairment in children: an exploratory study. *Language Testing 1*, 33–49.

Friedmann, N., & Novogrodsky, R. (2011). Which questions are most difficult to understand?: The comprehension of Wh questions in three subtypes of SLI. *Lingua*. *121*. 367-382. https://doi.org/10.1016/j.lingua.2010.10.004

Gardner, H., Froud, K., McClelland, A., & van der Lely, H. K. (2006). Development of the Grammar and Phonology Screening (GAPS) test to assess key markers of specific language and literacy difficulties in young children. *International Journal of Language & Communication Disorders*, *41*(5), 513–540. https://doi.org/10.1080/13682820500442644

Garbarino, J., Ratner, N. B., & MacWhinney, B. (2020). Use of Computerized Language Analysis to Assess Child Language. *Language, Speech, and Hearing Services in Schools*, *51*(2), 504–506. https://doi.org/10.1044/2020_LSHSS-19-00118

Gatt, D., Camilleri, L., & Grech, C. (2023). Word usage as measured by parental checklists and language samples: trends, comparisons, and implications. *Frontiers in Psychology*, *14*, 1214518. https://doi.org/10.3389/fpsyg.2023.1214518

Goldstein, B. (Ed.). (2022). *Bilingual language development & disorders in Spanish-English speakers* (3 rd edition). Paul H. Brookes Publishing Company.

Gonzalez, D. O., Cáceres, A. M., Bento-Gaz, A. C., & Befi-Lopes, D. M. (2012). The complexity of narrative interferes in the use of conjunctions in children with

specific language impairment. *Jornal da Sociedade Brasileira de Fonoaudiologia*, *24*(2), 152–156. https://doi.org/10.1590/s2179-64912012000200011

Gray, S., Brinkley, S., & Svetina, D. (2012). Word learning by preschoolers with SLI: effect of phonotactic probability and object familiarity. *Journal of Speech, Language, and Hearing Research. 55*(5), 1289–1300. https://doi.org/10.1044/1092-4388(2012/11-0095)

Grill, P. (2019). Classification of children with SLI through their speech utterances. In L. Lhotska, L. Sukupova, I. Lacković, & G. S. Ibbott (Eds.), *World Congress on Medical Physics and Biomedical Engineering 68*(2) 441–447. Springer Singapore. https://doi.org/10.1007/978-981-10-9038-7_83.

Gross, M. C., & Kaushanskaya, M. (2022). Language control and code-Switching in bilingual children with developmental language disorder. *Journal of Speech, Language, and Hearing Research. 65*(3), 1104–1127. https://doi.org/10.1044/2021_JSLHR-21-00332

Gutiérrez-Clellen, V., Simon-Cereijido, G., Leone, A. (2009). Codeswitching in bilingual children with specific language impairment. *The International Journal of Bilingualism: Cross-disciplinary, Cross-linguistic Studies of Language Behavior. 13.* 91-109. https://doi.org/10.1177/1367006909103530

Hasson, N., & Botting, N. (2010). Dynamic assessment of children with language impairments: A pilot study. *Child Language Teaching and Therapy 26*. 249-272. https://doi.org/10.1177/0265659009349982

Heilmann, J. J., Miller, J. F., & Nockerts, A. (2010). Using language sample databases. *Language, Speech, and Hearing Services in Schools*, *41*(1), 84–95. https://doi.org/10.1044/0161-1461(2009/08-0075)

Heilmann, J., Nockerts, A., & Miller, J. F. (2010). Language sampling: does the length of the transcript matter?. *Language, Speech, and Hearing Services in Schools*, *41*(4), 393–404. https://doi.org/10.1044/0161-1461(2009/09-0023)

Hewitt, L. E., Hammer, C. S., Yont, K. M., & Tomblin, J. B. (2005). Language sampling for kindergarten children with and without SLI: mean length of utterance, IPSYN, and NDW. *Journal of Communication Disorders*, *38*(3), 197–213. https://doi.org/10.1016/j.jcomdis.2004.10.002

Hick, R., Joseph, K., Conti-Ramsden, G., Serratrice, L., & Faragher, B. (2002). Vocabulary Profiles of Children with Specific Language Impairment. *Child Language Teaching & Therapy. 18.* 165-180. 10.1191/0265659002ct233oa.

Hosp, J. L. (2008). Best practices in aligning academic assessment with instruction. *Best Practices in School Psychology 5*, 363-376.

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

Jalilevand, N. (2014). Three measures often used in language samples analysis. *Journal of Child Language Acquisition and Development.* 1-12.

Kakvand, R. (2023). Social (Pragmatic) Communication Disorder in Children With Specific Language Impairment: Pragmatic Language Impairment. In D. V. Katsarou (Ed.), *Advances in Psychology, Mental Health, and Behavioral Studies* 101–120. IGI Global. https://doi.org/10.4018/979-8-3693-0644-4.ch008

Kambanaros, M., Michaelides, M., & Grohmann, K. K. (2015). Measuring word retrieval deficits in a multilingual child with SLI: Is there a better language? *Journal of Neurolinguistics, 34*, 112–130. https://doi.org/10.1016/j.jneuroling.2014.09.006

Kambanaros, M., & Grohman, K. K. (2015). More general all-purpose verbs in children with specific language impairment? Evidence from Greek for not fully lexical verbs in language development. *Applied Psycholinguistics*, *36*(5), 1029–1057. doi:10.1017/S0142716414000034

Kan .P. F, & Windsor .J. (2010).Word learning in children with primary language impairment: A meta-analysis. *Journal of Speech, Language, and Hearing Research. 53:* 739–756.

Kapantzoglou, M., Brown, J. E., Cycyk, L. M., & Fergadiotis, G. (2021). Code-Switching and Language Proficiency in bilingual children with and without developmental language disorder. *Journal of Speech, Language, and Hearing Research. 64*(5), 1605–1620. https://doi.org/10.1044/2020_JSLHR-20-00182

Kapantzoglou, M., Fergadiotis, G., & Restrepo, M. A. (2017). Language sample analysis and elicitation technique effects in bilingual children with and without language impairment. *Journal of Speech, Language, and Hearing Research*, *60*(10), 2852–2864. https://doi.org/10.1044/2017_JSLHR-L-16-0335

Katsos, N., Roqueta, C. A., Estevan, R. A., & Cummins, C. (2011). Are children with Specific Language Impairment competent with the pragmatics and logic of quantification?. *Cognition*, *119*(1),43–57 https://doi.org/10.1016/j.cognition.2010.12.004

Kettunen, K. (2014). Can Type-Token Ratio be Used to Show Morphological Complexity of Languages?. *Journal of Quantitative Linguistics*. *21*. 223-245. 10.1080/09296174.2014.911506.

Konting, M. M., Kamaruddin, N., & Man, N. A. (2009). Quality assurance in higher education institutions: exist survey among Universiti Putra Malaysia

graduating students. *International Education Studies*, 2(1). https://doi.org/10.5539/ies.v2n1p2

Klatte, I., van Heugten, V., Zwitserlood, R., & Gerrits, E. (2021). Language sample analysis in clinical practice: speech-language pathologists' barriers, facilitators, and needs. *Language, Speech, and Hearing Services in Schools. 53*. 1-16. https://10.1044/2021_LSHSS-21-00026.

Klee, T. (1992). Developmental and diagnostic characteristics of quantitative measures of children's language production. *Topics in Language disorders*, *12*(2), 28-41.

Lahey M, Edwards J. (1996). Why do children with specific language impairment name pictures more slowly than their peers? *Journal of Speech and Hearing Research.39:*1081–1098.

Lakkanna, S., Venkatesh, K., Bhat, J. S. & Karuppali, S. (2021). *Assessment of Language Development* – A Manipal Manual. Manipal Universal Press

Larson, A. L., Barrett, T. S., & McConnell, S. R. (2020). Exploring early childhood language environments: A comparison of language use, exposure, and interactions in the home and childcare settings. *Language, Speech, and Hearing Services in Schools*, 51(3).

Leonard, L. B. (2000). *Children with Specific Language Impairment* (1st MIT Press pbk. Ed). MIT Press.

Leonard, L. (2003). *Specific Language Impairment: Characterizing the deficit. Towards a definition of SLI*, 209-231. In Y. Levy & J. Schaeffer (Eds.), Lawrence Erlbaum Associates Publishers.

Leonard, L. B., Camarata, S., Rowan, L. & Chapman, K. 1982: The communicative functions of lexical usage by language impaired children. *Applied Psycholinguistics 3,* 109–25. 706–719. https://doi.org/10.1044/2019_LSHSS-19-00066

Leonard, L. B., Bortolini, U., Caselli, M. C., McGregor, K. K., & Sabbadini, L. (1992). Morphological Deficits in Children with Specific Language Impairment: The Status of Features in the Underlying Grammar. *Language Acquisition*, *2*(2), 151–179. http://www.jstor.org/stable/20011371

Leonard, L.B., Deevy, P., Karpicke, J.D., Christ, S., Weber, C., Kueser, J.B. & Haebig, E. (2019) Adjective learning in young typically developing children and children with developmental language disorder: a retrieval-based approach. *Journal of Speech, Language, and Hearing Research, 62*(12), 4433-4449.

Leyfer, O. T., Tager-Flusberg, H., Dowd, M., Tomblin, J. B., & Folstein, S. E. (2008). Overlap between autism and specific language impairment: comparison of Autism Diagnostic Interview and Autism Diagnostic Observation Schedule

scores. *Autism Research: Official Journal of the International Society for Autism Research*, *1*(5), 284–296. https://doi.org/10.1002/aur.43

Liu, L. X., Zahrt, D., & Simms, M. (2018). An Interprofessional team approach to the differential diagnosis of children with language disorders. *Pediatric Clinics of North America*. *65*. 73-90. https://10.1016/j.pcl.2017.08.022.

Liu, H., MacWhinney, B., Fromm, D., & Lanzi, A. (2023). Automation of Language Sample Analysis. *Journal of Speech, Language, and Hearing research*, *66*(7), 2421–2433. https://doi.org/10.1044/2023_JSLHR-22-00642

Losardo, A., & Notari-Syverson, A. (2011). *Alternative approaches to assessing young children* (2nd Edition). Paul H. Brookes Publications.

Loucas, T., Baird, G., Simonoff, E., & Slonims, V. (2016). Phonological processing in children with specific language impairment with and without reading difficulties. *International Journal of Language & Communication Disorders*, *51*(5), 581–588. https://doi.org/10.1111/1460-6984.12225

Luckman, C., Wagovich, S. A., Weber, C., Brown, B., Chang, S. E., Hall, N. E., & Bernstein Ratner, N. (2020). Lexical diversity and lexical skills in children who stutter. *Journal of Fluency Disorders*, *63*, 105747. https://doi.org/10.1016/j.jfludis.2020.105747

MacLeod, A. A., Laukys, K., & Rvachew, S. (2011). The impact of bilingual language learning on whole-word complexity and segmental accuracy among children aged 18 and 36 months. *International Journal of Speech-Language Pathology*, *13*(6), 490–499. https://doi.org/10.3109/17549507.2011.578658

Manning, B. L., Harpole, A., Harriott, E. M., Postolowicz, K., & Norton, E. S. (2020). Taking language samples home: feasibility, reliability, and validity of child language samples conducted remotely with video chat versus in-person. *Journal of Speech, Language, and Hearing Research*, *63*(12), 3982–3990. https://doi.org/10.1044/2020_JSLHR-20-00202

Maillart, C., Schelstraete, M. A., & Hupet, M. (2004). Phonological representations in children with SLI: a study of French. *Journal of Speech, Language, and Hearing research*, *47*(1), 187–198. https://doi.org/10.1044/1092-4388(2004/016)

Mainela-Arnold, E., Evans, J. L., & Coady, J. A. (2010). Explaining lexical-semantic deficits in specific language impairment: the role of phonological similarity, phonological working memory, and lexical competition. *Journal of Speech, Language, and Hearing Research*, *53*(6), 1742–1756. https://doi.org/10.1044/1092-4388(2010/08-0198)

Marina, L. P., Befi-Lopes, D. M., & Takiuchi, N. (2005). Use and comprehension of prepositions by children with Specific Language Impairment. *Pro-fono :*

Revista de Atualizacao Cientifica, *17*(3), 331–343. https://doi.org/10.1590/s0104-56872005000300007

Marinellie, S. A., & Johnson, C. J. (2002). Definitional skill in school-age children with specific language impairment. *Journal of Communication Disorders*, *35*(3), 241–259. https://doi.org/10.1016/s0021-9924(02)00056-4

Marini, A., Sperindè, P., Ruta, I., Savegnago, C., & Avanzini, F. (2019). Linguistic skills in bilingual children with developmental language disorders: A Pilot study.
Frontiers in Psychology, *10*,493.https://doi.org/10.3389/fpsyg.2019.00493

McArthur, G & Castles, A. (2013). Phonological processing deficits in specific reading disability and specific language impairment: Same or different?. *Journal of Research in Reading. 36*. 10.1111/j.1467-9817.2011.01503.x.

McCarthy, P. M., Jarvis, S. (2007). Voc-D: A theoretical and empirical evaluation. *Language Testing. 24* (4): 459–488. doi: 10.1177/0265532207080767.

McCarthy, P. M., & Jarvis, S. (2010). MTLD, vocd-D, and HD-D: a validation study of sophisticated approaches to lexical diversity assessment. *Behavior Research Methods*, *42*(2), 381–392. https://doi.org/10.3758/BRM.42.2.381

McKee. G., Malvern, D., Richards, B. (2000). Measuring vocabulary diversity using dedicated software. *Literary and Linguistic Computing. 15* (3):323–337.

Meir, N., & Armon Lotem, S. (2017). Delay or deviance: old question – new evidence from bilingual children with Specific Language Impairment (SLI). In M. LaMendola, & J. Scott (Eds.), *BUCLD 41: Proceedings of the 41st annual Boston University Conference on Language Development.* Cascadilla Press.

Miller, J. F., Andriacchi, K., & Nockerts, A. (2016). Using Language Sample Analysis to Assess Spoken Language Production in Adolescents. *Language, Speech, and Hearing Services in Schools*, *47*(2), 99–112. https://doi.org/10.1044/2015_LSHSS-15-0051

Miller, J. F., & Klee, T. (1995). Computational approaches to the analysis of language impairment. In Fletcher P & MacWhinney B (Eds.), *The Handbook of Child Language* (pp. 545–572). Oxford, England: Blackwell.

Miller, J. F. & Chapman, R.S. (2009). *SALT Software*, Retrieved from www.saltsoftware.com

Miller, J., & Iglesias, A. (2012). Systematic analysis of language transcripts (SALT), research version 2012 [computer software]. *Middleton, WI: Salt Software, LLC*.

Miller, J. F., Andriacchi, K., & Nockerts. A. (2015). Assessing Language Production Using SALT Software: A Clinician's Guide to Language Sample Analysis. Middleton, WI: SALT Software.

Mills, M. T., Watkins, R. V., & Washington, J. A. (2013). Structural and dialectal characteristics of the fictional and personal narratives of school-age African American children. *Language, Speech, and Hearing Services in Schools*, *44*(2), 211–223. https://doi.org/10.1044/0161-1461(2012/12-0021)

Montgomery, J. W. (1995). Examination of phonological working memory in specifically language-impaired children. *Applied Psycholinguistics. 16*. 355–378.

Montgomery, J. W., Gillam, R. B., & Evans, J. L. (2016). Syntactic Versus Memory Accounts of the Sentence Comprehension Deficits of Specific Language Impairment: Looking Back, Looking Ahead. *Journal of Speech, Language, and Hearing Research*, *59*(6), 1491–1504. https://doi.org/10.1044/2016_JSLHR-L-15-0325

Moore-Brown, B., Huerta, M., Uranga-Hernandez, Y., & Peña, E. D. (2006). Using Dynamic assessment to evaluate children with suspected learning disabilities. *Intervention in School and Clinic*, *41*(4), 209-217. https://doi.org/10.1177/10534512060410040301

Moscati, V., Rizzi, L., Vottari, I., Chilosi, A. M., Salvadorini, R., & Guasti, M. T. (2020). Morphosyntactic weaknesses in Developmental Language Disorder: the role of structure and agreement configurations. *Journal of Child Language*, *47*(5), 909–944. doi:10.1017/S0305000919000709

Moses, N., Reuterskiöld, C., & Klein, H. B. (2020). Language sampling and semantics in dynamic assessment : value, biases, solutions. *Journal of the National Black Association for Speech-Language and Hearing*, (3), 98–100.

Narayanan, S., Vijayan, K., Prabhu P., P., V. G., M. ., & Barman, A. (2021). Pragmatic Language Difficulties in Children with Specific Language Impairment – A Systematic Review. *Journal of Child Language Acquisition and Development*- 306–320. Retrieved from https://science-res.com/index.php/jclad/article/view/43

Nelson, N. W., & Van Meter, A. M. (2007). Measuring written language ability in narrative samples. *Reading & Writing Quarterly*, *23*(3), 287-309.

Newcomer, P. L., & Hammill, D. D. (2008). *TOLD-P:4 : Test of Language Development. Primary* (4th Edition.). Pro-Ed.

Newkirk-Turner, B. L., Oetting, J. B., & Stockman, I. J. (2016). Development of auxiliaries in young children learning African American English. *Language, Speech, and Hearing Services in Schools*, *47*(3), 209–224. https://doi.org/10.1044/2016_LSHSS-15-0063

Nippold, M. A., Frantz-Kaspar, M. W., Cramond, P. M., Kirk, C., Hayward-Mayhew, C., & MacKinnon, M. (2014). Conversational and narrative speaking in adolescents: examining the use of complex syntax. *Journal of Speech,*

Language, and Hearing Research, 57(3), 876–886. https://doi.org/10.1044/1092-4388(2013/13-0097)

Normand, M. T. L., & Chevrie-Muller, C. (1991). Individual differences in the production of word classes in eight specific language-impaired pre-schoolers. *Journal of Communication Disorders, 24* (5–6), 331-351. https://doi.org/10.1016/0021-9924(91)90007-6

Oetting, J.B., Rice, M.L. & Swank, L.K. (1995) Quick incidental learning (QUIL) of words by school-age children with and without SLI. *Journal of Speech, Language, and Hearing Research, 38*(2), 434-445.

Ogiela, D. A., & Montzka, J. L. (2021). Norm-Referenced Language Test Selection Practices for Elementary School Children With Suspected Developmental Language Disorder. *Language, Speech, and Hearing Services in Schools*, *52*(1), 288–303. https://doi.org/10.1044/2020_LSHSS-19-00067

Osman, D. M., Shohdi, S., & Aziz, A. A. (2011). Pragmatic difficulties in children with Specific Language Impairment. *International Journal of Pediatric Otorhinolaryngology*, *75*(2),171-76 https://doi.org/10.1016/j.ijporl.2010.10.028

Otsuka K., & Jay T. (2017). Understanding and supporting block play: video observation research on preschoolers' block play to identify features associated with the development of abstract thinking. *Early Child Development Care*, *187*, 990–1003. 10.1080/03004430.2016.1234466

Owen, A. J., & Leonard, L. B. (2002). Lexical diversity in the spontaneous speech of children with specific language impairment: application of D. *Journal of Speech, Language, and Hearing Research*, *45*(5), 927–937. https://doi.org/10.1044/1092-4388(2002/075)

Pattanayak, D. P. (1990). Multilingualism in India. *Multilingual Matters*

Pattanayak, D. (2008). Multilingual and multicultural India. *Lokaratna, 1*(1).

Patton, M.Q. (1980). *Qualitative Evaluation Methods.* Beverly Hills, CA: Sage.

Paul, R. (2017). *Language Disorders From a Developmental Perspective: Essays in Honor of Robin S. Chapman* (1 st Edition). Taylor and Francis.

Paul R., & Norbury C. F. (2012). *Language disorders from infancy through adolescence: Listening, speaking, reading, writing, and communicating* (4th edition). St. Louis, MO: Elsevier.

Pavelko, S., & Owens, R. (2022). A Sweet Tutorial to the SUGAR Method of Language Sampling. *Perspectives of the ASHA Special Interest Groups. 8*. 1-18. https://10.1044/2022_PERSP-22-00134

Pavelko, S. & Owens, R. (2017). Sampling Utterances and Grammatical Analysis Revised (SUGAR): New Normative Values for Language Sample Analysis Measures. *Language Speech and Hearing Services in Schools. 48.* 1. 10.1044/2017_LSHSS-17-0022.

Pezold, M. J., Imgrund, C. M., & Storkel, H. L. (2020). Using Computer Programs for Language Sample Analysis. *Language, Speech, and Hearing Services in Schools*, *51*(1), 103–114. https://doi.org/10.1044/2019_LSHSS-18-0148

Portell, M., Anguera, M. T., Chacón-Moscoso S., Sanduvete-Chaves S. (2015). Guidelines for reporting evaluations based on observational methodology. *Psicothema* 27 283–289. 10.7334/psicothema2014.276

Prasad, B & Rao, P. (2011). Code Switching in the lexical corpora of children. *Theory and Practice in Language Studies. 1*. https://doi.org/10.4304/tpls.1.5.471-477

Prasitha, P., & Prema, K. (2021). Specific Language Impairment: Development of Morphosyntax in Kannada. *International Journal of Scientific and Research Publications*, *11*(4) DOI: http://dx.doi.org/10.29322/IJSRP.11.04.2021.p11232

Price, L. H., Hendricks, S., & Cook, C. (2010). Incorporating computer-aided language sample analysis into clinical practice. *Language, Speech, and Hearing Services in Schools*, *41*(2), 206–222. https://doi.org/10.1044/0161-1461(2009/08-0054)

Price, J. R., & Jackson, S. C. (2015). Procedures for obtaining and analyzing writing samples of school-age children and adolescents. *Language, Speech, and Hearing Services in Schools*, *46*(4), 277–293. https://doi.org/10.1044/2015_LSHSS-14-0057

Ramus, F., Marshall, C. R., Rosen, S., & van der Lely, H. K. (2013). Phonological deficits in specific language impairment and developmental dyslexia: towards a multidimensional model. *Brain: A Journal of Neurology*, *136*(Pt 2), 630–645. https://doi.org/10.1093/brain/aws356

Rapin, I., & Allen, D.A. (1983). *Developmental language disorders: Nosologic considerations.* In: U. Kirk (Ed.), Neuropsychology of language, reading and spelling. San Diego, CA: Academic Press.

Rapin I. (1996). Practitioner review: developmental language disorders: a clinical update. *Journal of Child Psychology and Psychiatry, and Allied Disciplines*, *37*(6), 643–655. https://doi.org/10.1111/j.1469-7610.1996.tb01456.x

Ratner, N. B., Han, Y., & Yang, J. S. (2024). Should we stop using lexical diversity measures in children's language sample analysis?. *American Journal of Speech-Language Pathology*, 1–16. Advance online publication. https://doi.org/10.1044/2024_AJSLP-23-00457

Ratusnik, D. L., Klee, T. M., & Ratusnik, C. M. (1980). Northwestern Syntax Screening Test: A short form. *Journal of Speech & Hearing Disorders*, *45*(2), 200–208. https://doi.org/10.1044/jshd.4502.200

Reilly, S., Tomblin, B., Law, J., McKean, C., Mensah, F. K., Morgan, A., Goldfeld, S., Nicholson, J. M., & Wake, M. (2014). Specific language impairment: a convenient label for whom?. *International Journal of Language & Communication Disorders*, *49*(4), 416–451. https://doi.org/10.1111/1460-6984.12102

Rezzonico, S., Chen, X., Cleave, P. L., Greenberg, J., Hipfner-Boucher, K., Johnson, C. J., Milburn, T., Pelletier, J., Weitzman, E., & Girolametto, L. (2015). Oral narratives in monolingual and bilingual preschoolers with SLI. *International Journal of Language & Communication Disorders*, *50*(6), 830–841. https://doi.org/10.1111/1460-6984.12179

Rice, M. L., & Hoffman, L. (2015). Predicting vocabulary growth in children with and without specific language impairment: a longitudinal study from 2;6 to 21 years of age. *Journal of Speech, Language, and Hearing Research*, *58*(2), 345–359. https://doi.org/10.1044/2015_JSLHR-L-14-0150

Rice, M. L., & Oetting, J. B. (1993). Morphological deficits of children with SLI: evaluation of number marking and agreement. *Journal of Speech and Hearing Research*, *36*(6), 1249–1257. https://doi.org/10.1044/jshr.3606.1249

Richards, B. (1987). Type/Token Ratios: what do they really tell us? *Journal of Child Language*, *14*(2), 201–209. doi:10.1017/S0305000900012885

Rispens, J., & Been, P. (2007). Subject-verb agreement and phonological processing in developmental dyslexia and specific language impairment (SLI): a closer look. *International Journal of Language & Communication Disorders*, *42*(3), 293–305. https://doi.org/10.1080/13682820600988777

Roeper, Thomas. (2012). Minimalism and bilingualism: How and why bilingualism could benefit children with SLI. *Bilingualism: Language and Cognition. 15*. 88 - 101. 10.1017/S1366728911000605.

Rondal J. A., & DeFays D. (1978). Reliability of mean length of utterance as a function of sample size in early language development. *The Journal of Genetic Psychology: Research and Theory on Human Development*, 133, 305–306.

Rothweiler, M. (2007). 9. Multilingualism and Specific Language Impairment (SLI). In P. Auer & L. Wei (Ed.), *Handbook of Multilingualism and Multilingual Communication*.229-246. Berlin, New York: De Gruyter Mouton. https://doi.org/10.1515/9783110198553.2.229

Rudolph J. M. (2017). Case History Risk Factors for Specific Language Impairment: A Systematic Review and Meta-Analysis. *American Journal of Speech-Language Pathology*, *26*(3), 991–1010. https://doi.org/10.1044/2016_AJSLP-15-0181

Sheng, L., & McGregor, K. K. (2010). Lexical-semantic organization in children with specific language impairment. *Journal of Speech, Language, and Hearing Research*, *53*(1), 146–159. https://doi.org/10.1044/1092-4388(2009/08-0160)

Singhi, P., Kumar, M., Malhi, P., & Kumar, R. (2007). Utility of the WHO ten questions screen for disability detection in a rural community the North Indian experience. *Journal of Tropical Pediatrics*, *53*(6), 383–387. https://doi.org/10.1093/tropej/fmm047

Smeaton, A. F., & Sheridan, P. (1991). Using morpho-syntactic language analysis in phrase matching. *Proceedings RIAO 91*, 414–430, Paris, France.

Spector, R. E. (2002). Cultural Diversity in Health and Illness. *Journal of Transcultural Nursing*, *13*(3), 197–199. https://doi.org/10.1177/10459602013003007

Spencer, S. (2013). Language disorders from infancy through adolescence: listening, speaking, reading, writing and communicating. *International Journal of Language & Communication Disorders*, *48*(6), 738–739. https://doi.org/10.1111/1460-6984.12031

Spradley, J. P. (1979). *The ethnographic interview*. Holt, Rinehart and Winston.

Stark, R. E., & Tallal, P. (1981). Selection of children with specific language deficits. *The Journal of Speech and Hearing Disorders*, *46*(2), 114–122. https://doi.org/10.1044/jshd.4602.114

Storkel, H.L. (2004). Methods for minimizing the confounding effects of word leangth in the analysis of phonotctic probability and neighborhood density. *Journal of Speech, Language, and Hearing Research. 47.* 1454–1468.

Stills, M. (2016). *Language sample length effects on various lexical diversity measures: An analysis of Spanish language samples from children*. Thesis no. 223. University Honors Theses. [Portland State University] https://doi.org/10.15760/honors.250

Suchithra, M.G. & Karanth, P. (2007). Linguistic profile test-normative data for children in grades VI to X (11+ years-15+ years). *Journal of All India Institute of Speech and Hearing. 26*. 1-6.

Sutomo, J. (2012). English phonological processes: A study of Generative Phonology theory. *Dinamika Bahasa Dan Budaya*, *7*(2), 53-64. https://doi.org/10.35315/bb.v7i2.485

Swapna, N., Jayaram, M., Prema, K.S., & Geetha,Y.V. (2010).*Assessment checklist for Speech and Language Skills.* AIISH research funded project.

Swingley D. (2017). The infant's developmental path in phonological acquisition. *British Journal of Psychology (London, England: 1953)*, *108*(1), 28–30. https://doi.org/10.1111/bjop.12215

Szukiel, B., Górska, M., & Kruk, U. (2017). Differential Diagnosis of Specific Language Impairment – SLI. *Polish Journal of Applied Sciences, 3*(1), 5-10. https://doi:10.19260/PJAS.2017.3.1.01

Tallal, P., Miller, S., Bedi, G., Byma, G., Wang, X., & Nagarajan S. (1996). Language comprehension in language-learning impaired children improved with acoustically modified speech. *Science. 271:* 77–81.

Tamis-LeMonda, C. S., Bornstein, M. H., & Baumwell, L. (2001). Maternal responsiveness and children's achievement of language milestones. *Child Development*, *72*(3), 748–767. https://doi.org/10.1111/1467-8624.00313

Taylor, L. J., Maybery, M. T., Grayndler, L., & Whitehouse, A. J. (2015). Evidence for shared deficits in identifying emotions from faces and from voices in autism spectrum disorders and specific language impairment. *International Journal of Language & Communication Disorders*, *50*(4), 452–466. https://doi.org/10.1111/1460-6984.12146

Thomas, S., Schulz, J., & Ryder, N. (2019). Assessment and diagnosis of Developmental Language Disorder: The experiences of speech and language therapists. *Autism & Developmental Language Impairments*, 4. https://doi.org/10.1177/2396941519842812

Thordardottir, E, T., & Namazi, M. (2007). Specific language impairment in French-speaking children: Beyond grammatical morphology. *Journal of Speech, Language, and Hearing Research. 50* :698–714.

Thornton, R., Rombough, K., Martin, J., & Orton, L. (2016). Negative sentences in children with specific language impairment. *First Language*, *36*(3), 228-264. https://doi.org/10.1177/0142723716640187

Tomblin, J. B., Records, N. L., & Zhang, X. (1996). A system for the diagnosis of specific language impairment in kindergarten children. *Journal of Speech and Hearing Research*, *39*(6), 1284–1294. https://doi.org/10.1044/jshr.3906.1284

Togher L. (2001). Discourse sampling in the 21st century. *Journal of Communication Disorders*, *34*(1-2), 131–150. https://doi.org/10.1016/s0021-9924(00)00045-9

Tiwari, S., Karanth, P., & Rajashekar, B. (2017). Specific language impairment in a morphologically complex agglutinative Indian language Kannada. *Journal of Communication Disorders*, *66*, 22–39. https://doi.org/10.1016/j.jcomdis.2017.03.002

Venkatesan, S. (2009). Ethical guidelines for bio-behavioural research involving human subjects. All India Institute of Speech and Hearing, Mysore. [Retrieved from http;//www.aiishmysore.in/en/pdf/ethical_guidelines.pdf]

Venkatesan, S. (2011). Socio-Economic Status Scale-Mysore, AIISH. Revised version of “NIMH Socio-Economic Status Scale-1993”. Secunderabad: NIMH.

Vermeer, A. (2000). Coming to grips with lexical richness in spontaneous speech data. *Language Testing*, *17*(1), 65–83. https://doi.org/10.1177/026553220001700103

Watkins, R. V., Kelly, D. J., Harbers, H. M., & Hollis, W. (1995). Measuring children's lexical diversity: differentiating typical and impaired language learners. *Journal of Speech and Hearing Research*, *38*(6), 1349–1355. https://doi.org/10.1044/jshr.3806.1349

Watkins, R., Rice, M. and Moltz, C. 1993: Verb use by language-impaired and normally developing children. *First Language 13*, 133–4.

Westby, C. (2021). Assessing Language Samples. *Word of Mouth*. https://doi.org/10.1177/10483950211059898a

Westby, C.E. (1989). Cultural differences in caregiver-child interactions: In L. Cole and V. Deal (Eds.), *Communication Disorders in Multicultural Populations.* Washington, DC: ASHA.

Westby, C. E. (1990). Ethnographic interviewing: asking the right questions to the right people in the right ways. *Journal of Childhood Communication Disorders*, *13*(1), 101–111. https://doi.org/10.1177/152574019001300111

Westerveld, M. F., & Claessen, M. (2014). Clinician survey of language sampling practices in Australia. *International Journal of Speech-Language Pathology*, *16*(3), 242–249. https://doi.org/10.3109/17549507.2013.871336

Weston, A. D., Shriberg, L. D., & Miller, J. F. (1989). Analysis of language-speech samples with salt and pepper. *Journal of Speech and Hearing Research*, *32*(4), 755–766. https://doi.org/10.1044/jshr.3204.755

Whitehouse, A. J., Barry, J. G., & Bishop, D. V. (2007). The broader language phenotype of autism: a comparison with specific language impairment. *Journal of Child Psychology and Psychiatry, and Allied Disciplines*, *48*(8), 822–830. https://doi.org/10.1111/j.1469-7610.2007.01765.x

Wiig, E. H., Semel, E., & Secord, W. A. (2013). Clinical Evaluation of Language Fundamentals-Fifth Edition (CELF-5). Bloomington, MN: NCS Pearson.

Wong, A. M., Klee, T., Stokes, S. F., Fletcher, P., & Leonard, L. B. (2010). Differentiating Cantonese-speaking preschool children with and without SLI using MLU and lexical diversity (D). *Journal of Speech, Language, and Hearing Research*, *53*(3), 794–799. https://doi.org/10.1044/1092-4388(2009/08-0195)

Wood, C. L., Bustamante, K. N., Schatschneider, C., & Hart, S. A. (2019). Relationship between children's Lexical Diversity in written narratives and performance on a standardized reading vocabulary measure. *Assessment for Effective Intervention: Official Journal of the Council for Educational Diagnostic Services*, *44*(3), 173–183. https://doi.org/10.1177/1534508417749872

World Health Organization. (2007). *ICF-CY International Classification of Functioning Disability and Health : Children & Youth version*. World Health Organization.

World Health Organization. (2010). *ICD-10: International Statistical Classification of Diseases and Related Health Problems (10th Rev. Edn)* Geneva: World Health Organization.

Wright, H., Silverman, S., & Newhoff, M. (2003). Measures of lexical diversity in aphasia. *Aphasiology*, *17*(5),443–452. https://doi.org/10.1080/02687030344000166

Yang, J. S., Rosvold, C., & Bernstein. R.N. (2022). Measurement of Lexical Diversity in Children's Spoken Language: Computational and Conceptual Considerations. *Frontiers in Psychology*, *13*, 905789. https://doi.org/10.3389/fpsyg.2022.905789

Youmans, G. (1991). A New Tool for Discourse Analysis: The Vocabulary-Management Profile. *Language*, *67*(4), 763. https://doi.org/10.2307/415076

Yow, W. Q., Tan, J. S. H., & Flynn, S. (2018). Code-switching as a marker of linguistic competence in bilingual children. *Bilingualism: Language and Cognition*, *21*(5), 1075–1090. doi:10.1017/S1366728917000335.

APPENDIX

Stimulus for picture description (Diddee, 2013)